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The Canadian
Medical Association Journal

VOL. VIII. SEPTEMBER, 1918 No. 9

COMBINED INQUIRY INTO THE PRESENCE OF DIPHTHERIA AND DIPHTHEROID BACILLI IN OPEN WOUNDS

BY COLONEL J. G. ADAMI, MAJOR F. B. BOWMAN, CAPTAINS F. ADAMS, A. G. FLEMING, C. D., FARQUHARSON, C. IMRIE, and R. M. JANES, C.A.M.C.

THERE appeared in the *Journal of the American Medical Association* for September 8th, 1917, an article by Majors J. G. Fitzgerald and D. E. Robertson of No. 2 Military Division, Canada, entitled "Report of an Outbreak of Diphtheric Wound Infection among Returned Soldiers." These observers report that as the result of a thorough investigation of all infected wounds in returned men of the C.E.F. in their Division, carried out between May 20th and June 7th, 1917, no less than forty out of sixty-seven cases afforded cultures of *B. diphtheriæ*. They admit that in some cases the infection may well have been conveyed from case to case by a nurse whose duty it was to dress the suppurating amputation cases. This nurse was found to have a slight wound of the index finger which yielded cultures of *B. diphtheriæ;* particulars are given which indicate that she may have distributed the infection from wound to wound. That she could not be held entirely responsible for the outbreak is shown by the fact that other cases with infected wounds showed themselves in soldiers who had returned to Canada after the nurse had been taken off duty and sent to the isolation department; two or three cases were discovered in men immediately upon their arrival in Toronto from overseas. And the authors conclude: "It was extremely probable, therefore, that patients with diphtheric wound infection were being returned to Canada from overseas."

The extraordinarily high proportion of positive cases affording cultures of the diphtheria bacillus from wounds in this outbreak is undoubtedly calculated to afford the impression that infection of open wounds with *B. diphtheriæ* is a common, not to say widespread, condition in military hospitals overseas. That the characteristic membrane formation occurred in certain of their cases, but not in all, is evident from their description and illustrations. From that description it is equally evident that in some cases the existence and isolation of virulent Klebs-Loeffler bacilli was proved by inoculation experiments. Their paper would have been more complete had precise figures been given regarding these matters, One of the two authors is a bacteriologist and serologist of distinction, Director of the Serological Institute of the University of Toronto, to the activities of which, in the preparation of antitoxins and vaccines, the Canadian Expeditionary Force and Canada at large is heavily indebted. Of the existence of the epidemic in Ontario in 1917 there is no doubt; that there were cases of infection of wounds with virulent diphtheria bacilli and membrane formation is not disputed. The fact that some of the cases are reported to have afforded cultures of the diphtheria bacillus immediately upon arrival in Toronto from overseas, rendered it essential than in England an inquiry be set on foot to determine the frequency of the presence of *B. diphtheriæ* and allied diphtheroids in the wounds of patients in Canadian military hospitals.

To our knowledge no such investigation on an adequate scale has hitherto been attempted. It is not an easy matter, but on the contrary demands much laborious work on the part of the bacteriologist, and when it is remembered that in hospitals of 1,500 to 2,000 beds the daily routine is in itself sufficient to occupy fully the time of the laboratory staff, the additional work thrown upon that staff by an investigation of this order is no light matter. It is not sufficient to make smear cultures from the wounds upon Loeffler's blood serum, and to call any granulated bacteria diphtheria bacilli, and that because non-toxic diphtheriods may be present in wounds and may grow equally well upon "Loeffler," and, what is more, in general when stained may show the palisade arrangement and the metachromatic granules that used to be regarded as characteristic of the Klebs-Loeffler bacillus. All such bacteria have next to be gained in pure culture, and put through their paces on media containing different "sugars". This will throw out all the diphtheroids. But even this is insufficient. There are strains which morphologically and by fermentation test

conform wholly with the *B. diphtheriæ*, but are absolutely harmless. It is necessary with every strain answering to the properties of the *B. diphtheriæ* to conduct inoculations upon the guinea-pig, thereby to determine whether it is harmless or pathogenic, or if such a course be regarded as a "counsel of perfection" this must be laid down, namely (1) that in the absence of clinical signs no bacillus can be accepted as the genuine Klebs-Loeffler bacillus without the confirmatory proof of inoculation, and (2) that where in a wound there is glazing and membrane formation, inoculation must be employed to demonstrate that this is due to the diphtheria bacilli present, and not to the *Micrococcus aureus* or other organism; when this has been proved, then other cases in the ward showing membrane formation may reasonably be diagnosed as diphtherial from microscopical and cultural findings without the test of inoculation.

Early in August information regarding the outbreak in No. 2 Military Division was forwarded by the D.G.M.S., Ottawa, to the D.M.S. Canadians, and the A.D.M.S. in England were advised and asked to issue the necessary instructions for a bacteriological examination of all open suppurating wounds in Canadian hospitals (A.M.D. 25-1-5 of August 10th, 1917). If the number of cases in any area was very large, it was held sufficient that every alternate case be examined. So also it was asked that the personnel of the hospitals be examined to determine the existence of diphtheria "carriers". Subsequently in the Shorncliffe area this examination for carriers was restricted to a group of the larger hospitals, active and convalescent.

"Carriers"

As regards carriers, the outcome of the investigation was to demonstrate a striking absence of carriers among the personnel of the different hospitals. Most hospitals report "all negative". The pathologists at Eastbourne and Orpington (Captains Douglas and Imrie) afforded nominal rolls of the personnel examined. At the former hospital cultures from the throats of one hundred and fifty-seven officers, N.C.Os., nursing sisters, and men yielded no Klebs-Loeffler bacilli, and only three growths of diphtheroids (no *B. diptheriæ*). Similarly from Orpington the report showed one hundred and eleven of the personnel examined, not a single culture obtained of the Klebs-Loeffler bacillus, but twenty-four throats yielded Hofmann's bacillus (the common diphtheroid of the throat).

Infection of Wounds. Preliminary Observations

The replies regarding the bacteriological examination of suppurating wounds were not so complete. Many hospital laboratories were not in a position to carry out the investigation, they were not equipped for an investigation on so extensive a scale, nor had they the requisite staff to carry it out in addition to the insistent routine work. Captain Fleming, pathologist at the Duchess of Connaught Canadian Red Cross Hospital at Taplow, reported that for some little time in connexion with the Carrel-Dakin and Flavine treatment of wounds they had conducted a routine examination, with cultures, of all suppurating wounds, and had never encountered *B. diphtheriæ*. Captain T. R. Little reported from the Central Laboratory at Hastings that few cases with suppurating wounds came into the hospitals of that area; he had made a full bacteriological examination of six cases, of which four yielded diphtheria-like organisms. 0·5 c.c. of a standard suspension of a twenty-four-hour culture of *B. diphtheriæ* inoculated into guinea-pigs or young rabbits will cause death within seventy-two hours. Taking these four cultures he had inoculated with 0·5, 1·0 and 1·5 c.c. of suspensions of each into young half-grown rabbits, and not one of them had succumbed. It deserves note that prior to the war, Captain Little had been engaged upon a study of the diphtheroids.

Combined Investigation

Here the matter rested until the appearance of the paper above-mentioned by Majors Fitzgerald and Robertson, when the D.M.S. Canadians directed that at the Central Laboratory, Folkestone, and at Nos. 4, 15 and 16 Canadian General Hospitals, a combined investigation be made into the matter of the infection of open wounds by members of the diphtheria group. At these centres it was considered that conditions were such, both as regards the nature of the cases admitted and the laboratory accommodation, as to afford the most favourable conditions for the inquiry. Subsequently it was found that the laboratory at No. 4 Canadian General Hospital was not prepared to undertake the investigation, this hospital having only recently been transferred from Salonika, and the laboratory was not as yet in full working order.

From the office of the D.M.S. directions were forwarded to each participating laboratory detailing the scope and plan of the

investigation. These directions were full and precise. Their main features may here be referred to in abstract. The attempt was made to reduce to a minimum the procedure for differentiating between the different members of the diphtheria group, and to provide methods which had been tested and proved reliable. (1) Sterilized swabs, labelled, were to be provided for use in the wards. (2) Fresh smears were to be examined by either Loeffler's or Neisser's method, and attention was called to the fact that the majority of wound diphtheroids are indistinguishable from the Klebs-Loeffler bacillus under the microscope. (3) Blood serum plates were recommended in place of slanted test tubes for the first cultures. (4) Pure cultures of the diphtheroids recognized were to be obtained on blood serum slants (*B. diphtheriæ* colonies remain white, wound diphtheroids often, as they become older, acquire a pinkish or yellowish tinge). (5) For the sugar tests of these pure cultures Hiss's serum water medium was recommended as base, plus 1 per cent. of the sugar, together with azolitmin or litmus as indicator.* Four sugars only were to be used; dextrose, lactose, saccharose, and dextrine. These four saccharides were chosen in the first place to ensure the recognition of *B. diphtheriæ*. Dextrose (glucose) is a typical monosaccharide, lactose a useful disaccharide. Neither saccharose (sucrose) nor dextrine are for general bacteriological purposes regarded as of first importance, *i.e.*, with other bacterial species. The latter, it is true, is a representative polysaccharide, yet care is requisite in the preparation of dextrine broth, lest it be overheated and undergo hydrolysis with production of dextrose and levulose (this was noted in the directions given). But with a striking constancy the Klebs-Loeffler bacillus ferments dextrine with production of acid, and fails to ferment saccharose. Saccharose and lactose are also useful in differentiating between the other members of the group. As regards the other saccharides, levulose (as between the main members of the group) reacts in the same way as does dextrose, and might therefore be excluded. The same is largely true of maltose, and where it is not, the confusion that has been introduced by some members of what in other respects is the same sub-group fermenting this sugar, and others failing to ferment it, renders its employment inadvisable. Mannite could be neglected, since it is not fermented by any members of the group.

* Mellon objects that litmus is not a sufficiently delicate indicator, and recommends Andrade's medium, or, failing this, neutral red. Azolitmin was recommended after a careful test. Major Bowman and Captain Adams found that constant results were obtained by eight days' and even by four days'-growth in the Hiss's medium.

Other glucosides are both difficult to procure in a state of purity, and when procured do not afford constant results; their use, that is to say, is corroborative rather than of fundamental importance. We admit that glycerine might have been added to the series. Mellon has found this representative of the alcohols of distinct service in differentiating between the diphtheroids. Our object, however, was not so much to make a full differentiation between the many members of the group, as with the greatest economy of material and labour to recognize the main types, and above all to distinguish clearly between *B. diphtheriæ* and the other members. All forms which produced acid with dextrose and dextrine, and were negative with saccharose, were to be regarded provisionally as the Klebs-Loeffler bacillus; all others as diphtheroids. The following formulæ were afforded:

	Dextrose	Lactose	Saccharose	Dextrine
B. diphtheriæ	+	+	—	+
B. hofmanni	—	—	—	—
B. xerosis	+	—	+	—
Wound diphtheroids	+	+	+	+

(6) *Toxin Formation.*—The determining test as between the diphtheria bacillus and diphtheroids is toxin formation. The investigation was planned to discover in the first place whether virulent microörganisms are to be encountered in open wounds, and only in the second place how frequently other members of the group gain entrance to wounds. What determines whether a given organism is the true Klebs-Loeffler bacillus, and therefore of serious import, is not its morphology or staining reactions, or cultural characteristics, but its capacity to produce ectotoxins, and thus to affect the health of the patient. Detailed directions were therefore given as to the preparation of a broth, according to Dean's method, found to be most favourable for the rapid production of toxins. Having made twenty-four hours' growths in Erlenmeyer flasks of the bacilli to be tested, a guinea-pig was to be inoculated subcutaneously with 1·0 c.c. of the same. If toxic effects were produced, then four guinea-pigs were to be taken; two of them were to be given each 300 units of anti-diphtheria serum, and now one normal and one immunized guinea-pig were to be inoculated with 0·5 c.c. of the twenty-four hours' broth culture, and the other pair with 1·0 c.c. If the growth was one of true virulent diphtheria bacilli, the larger dose should cause death of the untreated guinea-pig within twenty-four hours.

A separate report was asked for each case affording members of the group, both true Klebs-Loeffler bacilli and diphtheroids.

It is generally agreed by those engaged in this investigation that no dependence can be placed upon smears from wounds as discovering the presence or absence of bacilli of the diphtheria group. This fact, in itself, is evidence of the absence of widespread diphtherial wound infection. Where there is widespread infection with membrane formation it should not be difficult to encounter the characteristic bacilli in relative abundance. Presence or absence of diphtheroids was determined by smears from the first, mixed, cultures on blood serum plates. This has introduced a difficulty in affording exact statistics, *e.g.*, at Folkestone bacilli resembling *B. diphtheriæ* were detected forty-one times, and that from forty cases, but from only twenty-four out of these forty cases were pure cultures isolated and studied,* one wound affording two separate diphtheroid organisms. Thus our first table giving the number of cases affording bacilli belonging to this group does not tally with the second table giving the relative frequency of the different members of the group isolated.

Results

The results obtained by this combined investigation may here be succinctly tabulated:

Laboratory and Observer	Number of cases examined	Number affording true *B. diphtheriæ*	Number affording diphtheroids
No. 1 Canadian General Laboratory, Folkestone. Captain F. Adams.....	121	1	40
No. 16 Canadian General Hospital, Orpington. Captain C. Imrie.....	60	1	7
No. 15 Canadian General Hospital, Taplow.			
(1) Captains A. G. Fleming and R. M. Janes.....	100	0	0
(2) Captain C. D. Farquharson.....	25	0	9
	306	2	56

The following additional data deserve note:

(1) *Folkestone.*

Two cases afforded growths which culturally, tinctorially, and

* That any of the seventeen remaining cases were those of true diphtherial infection is improbable from the fact that the method of isolation employed was that which has proved itself the optimum for isolation of *B. diphtheriæ.*

by the fermentation tests had the properties of the Klebs-Loeffler bacillus. One of these (No. 69, a sloughing stump of the thigh) afforded two separate strains of diphtheria-like bacilli. Of these one gave the sugar reactions of a wound diphtheroid, the other of the Klebs-Loeffler bacillus. Upon inoculation into guinea-pigs both were found non-virulent, like results being obtained on repeating the test. The other case (No. 77), with a granulating ulcer on the leg, gave virulent diphtheria bacilli, 1·0 c.c. of the broth culture causing death within forty-eight hours, with œdema at the site of injection and bright red suprarenals. Regarding this case, it is interesting to note that further inquiries elicited that the man had been isolated when coming out of the trenches in France as a case of suspected diphtheria. The strains of wound diphtheroids isolated were almost entirely of the *B. xerosis* type, one alone affording the sugar reactions characteristic of *B. hofmanni*.

Captain Adams reports at a later date "the cultures that gave the proper sugar reactions for true diphtheria kept on sub-culture their small colonies, characteristic morphology and staining for at least two months. On the other hand the diptheroids, after a week or two, changed their character. The colonies originally too robust for true diphtheria became still bigger, and many of the strains developed a creamy or pink colour. The bacilli also shortened, and many strains lost their granules."

(2) *Orpington.*

Captain Imrie's report from Orpington is strikingly similar, both as regards the immediate and the late results. Here also two strains were isolated which, until inoculation tests were made, appeared both to be the genuine Klebs-Loeffler bacilli; upon inoculation one of the two was found to be non-virulent. The other diphtheroids were of the usual wound diphtheroid type (negative to dextrine) with one exception. He likewise calls attention to the coarser, more confluent growth of the diphtheroids isolated by nim, and their assumption of a yellowish colour.

(3) *Taplow.*

The results at Taplow are curious and interesting. Captain Fleming had prior to the war made yearly for the Toronto Board of Health several thousand examinations, microscopical and cultural, in cases of diphtheria and suspected diphtheria. Add to this that for months he had been engaged upon the routine study of wound bacteriology at Taplow, particularly in connexion with the progress of wounds subjected to the Carrel-Dakin treatment. Prior to taking up this particular investigation he had never en-

countered diphtheria-like bacilli at No. 15 Military Hospital. For the purpose of this examination he and Captain F. M. Janes studied approximately 100 wounds by the routine laid down (they forward sixty detailed negative reports and offered to make out the remainder if desired). An analysis of the sixty reports forwarded shows that swabs were made from open wounds of various orders and varying duration from two weeks to twenty-two months, subjected to various orders of treatment, drainage (nine cases), Dakin's (thirteen), fomentations (five), saline (twenty-one), etc. These results varied so widely from those obtained at Folkestone and Orpington that the two observers offered to engage in another series, when both were transferred elsewhere. Captain Farquharson, who succeeded, undertook this additional investigation some two months later, and now in a series of twenty-five cases encountered diphtheroids nine times. Of these nine only one was the commoner type of wound diphtheroid negative to dextrine, five were of the rarer type fermenting dextrine, two were of the xerosis type, and one *B. hoffmanni*.

Combining these results into a table we find the following:

Dextrose	Lactose	Saccharose	Dextrine		Folkestone	Orpington	Taplow	Total number of diphtheroids
+	+	+	+	Wound diphtheroids (type I)	0	1	5	6
+	+	+	—	(type II)	0	5	1	6
+	+	—	+	*B. diphtheriæ*, virulent	1	1	0	2
+	+	—	+	" non-virulent	1	1	0	2
+	—	+	—	Wound diphtheroids(III), xerosis type	21	0	2	23
—	—	—	—	*B. hofmanni*	1	0	1	2

Taking these two tables it will be observed that the results obtained are strikingly at variance with those reported by Majors Fitzgerald and Robertson. In place of forty out of sixty-seven cases, or practically 60 per cent. of open wounds affording cultures of true virulent Klebs-Loeffler bacillus, we find two out of (approximately) three hundred and six, or under 0·6 per cent. Even if we accept the non-virulent bacilli of Klebs-Loeffler type as true diphtheria bacilli, the figure is raised only to a little over 1·0 per cent. The total number of diphtheroid strains isolated affords a percentage far below that of the *B. diphtheriæ* isolated by the Toronto observers.

Discussion

In a careful bacteriological study of open wounds made at three important Canadian medical centres in England there is complete absence of widespread infection of wounds by *B. diphtheriæ*. The Toronto epidemic of such infection is, we believe, the first recorded among the soldiers of the Allied Powers during the course of this war.

It is well recognized to-day that non-pathogenic diphtheroids are widely spread. Even these, while commoner, are not frequent inhabitants of wounds.

Thanks more particularly to the introduction of the newer methods of antiseptic treatment of wounds, never has there been so extensive and intensive a study of the bacteriology of wounds as during the present war. For the establishment and control of these newer methods repeated cultures have come into vogue, and had diphtherial infection been common in Europe, numerous observers would before this have called attention to the fact. We find, on the contrary, no reports upon the epidemic spread of diphtherial infection. That individual cases occur our own observations clearly demonstrate. What is more, in addition to the two cases here reported, two other cases have been notified as occurring at No. 5 Canadian General Hospital, Liverpool. But upon further inquiry into these cases we learn that in the earlier of the two (Pte. P——, 228808) this was recorded by the Pathological Department of the Thompson-Yates Laboratories of the University of Liverpool as yielding a free growth of staphylococci and "a few apparently typical diphtheria bacilli." With regard to the second case, that from Sergeant W——, 38385, this was one of eight swabs received, and was returned as positive. In neither case were tests made for pathogenicity. The officer in charge of the 1st Western General Laboratory, who reports these facts, states further that owing to the cost of guinea-pigs, pathogenicity tests are not made as a routine; occasionally attention is drawn to the fact that diphtheria-like bacilli are not necessarily pathogenic, and he adds: "Only recently an assistant in a neighbouring laboratory had diphtheria-like bacilli present in the throat which, however, were negative to the pathogenicity test." It will be seen thus that diagnosis in these two cases was made simply from the appearance of the mixed cultures obtained from swabs, and that this being the case, the evidence that these two patients showed

genuine and virulent diphtheria bacilli in their wounds is far from complete.

That epidemic spread of diphtherial infection of wounds might under circumstances manifest itself is freely admitted. In Major Fitzgerald and Robertson's account of the nurse with the infected finger we have an excellent instance of how this may be brought about. We are, however, of the opinion that the widespread use of eusol, Dakin's mixture, flavine, and other antiseptic solutions in Canadian hospitals in England has reduced the danger of such spread to a negligible amount. As regards the non-pathogenic diphtheroids, indeed, our figures indicate, we consider, the existence of a low grade of local or endemic prevalence. Thus it is deserving of note that wound diphtheroid (I) was the common form at Taplow, wound diphtheroid (II) at Orpington, while bacilli of the xerosis type predominated in the Folkestone area. We would not, however, lay too great a stress upon these findings.

On the Classification of the Diphtheroids

It may be asked by those who have not followed the literature: What is the nature of these wound diphtheroids?

In 1888 von Hofmann-Wellenhof of Graz, in Austria, called attention to the frequent presence in the throat and mouth of a perfectly harmless Gram-positive bacillus of irregular breadth which might easily be mistaken for the true diphtheria bacillus. Loeffler in his original communications had noted the existence of these harmless forms. For years this was regarded as an attenuated strain of the virulent germ, and as such spoken of a *B. pseudo-diphthericus*. With the discovery that this form was incapable of fermenting dextrose and other sugars, and was therefore quite distinct from the Klebs-Loeffler organism, the first name was seen to be inappropriate, and now this form is more generally known as *B. hofmanni*. Slowly, but at an increasing rate, other non-diphtherial organisms have been detected in the air, in water, and in the human body and its passages, often becoming regarded as the cause of one or other condition of disease, *e.g.*, Hodgkin's disease, general paralysis, etc., until it came to be recognized as urgent that the group should be carefully studied, and the members classified.

The first notable attempt at such a classification on any considerable scale was made by Hoag* of Boston in 1907. He made

* *Boston Med. and Surg. Journ.*, 1907, x, 197.

an analysis of the properties of the hundred and ninety-nine pure cultures of members of the groups, including among these one hundred and forty-six growths of what he termed provisionally "organism X" (a diphtheroid which he had isolated more particularly from the insane patients at the Danver Insane Hospital), seventeen strains of the Klebs-Loeffler bacillus, four of Hofmann's bacillus, etc. A still more thorough analysis was made in 1912 by Miss Morse of Chicago.* Her study of two hundred and ninety-five different strains following the biometric methods of Theobald Smith and Winslow was so thorough and analytical that even if we are on the eve of a revolution in the method of determining the acidity and alkalinity of media, her results must remain as the basis of the scientific classification of this group. A year later Hine† in Great Britain published an article based upon his unpublished thesis of 1906, in which, basing himself upon the study of the biochemistry of seventy-one different cultures of various diphtheroids, he arrived at conclusions very similar to those of Miss Morse.‡

Miss Morse recognized six groups (two groups or sub-groups of *B. diphtheriæ* distinguished by fixed morphological differences, the one less virulent than the other, *B. hofmanni*, *B. xerosis*, *B. hoagii*, and *B. flavidus*); Hine recognized five main groups (*B. diphtheriæ*, *B. hofmanni*, *B. coryzæ segmentosus* (Cautley), a group of skin diphtheroids, and another of urethral diphtheroids.

Last year, Mellon,§ of Harvard Medical School, published the results of another exhaustive study of the group. Employing as many as ten different saccharides, he makes out no less than seven sub-groups of the diphtheroids, or, including *B. diphtheriæ*, eight. Experience must show whether he is justified in making this extensive subdivision. This is not the place to enter fully into the vexed matter of the specific value of fermentation tests. In connexion with this diphtheroid group, as with other groups of pathogenic bacteria, those who have made the fullest and most

* *Journ. of Inf. Diseases*, 1912, xi, 253.

† *Journ. of Pathology and Bacteriology*, 1913, xviii, 75.

‡ In 1906 (*Journ. of Hygiene*, 1906, vi, 286), and later in 1908, in the well-known volume by Nuttall and himself ("Bacteriology of Diphtheria," p. 161), Graham Smith described and named a considerable number of diphtheroids. He did not, however, make a study of the fermentative activities on a sufficiently extensive scale, so that, willing as we are to credit his pioneer work, it is difficult to place precisely his various species or sub-species. Add to this, by the laws of botanical nomenclature, several of his designations, being trinomial, are inadmissible.

§ *Journ. of Bacteriology*, 1917, ii, 269.

exact studies are most willing to admit the wide variations that occur even in the fermentative activities of strains about whose allocation there can be no reasonable doubt. Thus, for example, Graham Smith has recorded an epidemic of diphtheria in which many of the cultures isolated fermented saccharose vigorously. On the other hand, it has to be admitted that with regard to specific sugars well defined groups in general show a striking constancy in their action. It is, for example, a perfectly sound rule to lay down that a diphtheroid which ferments dextrose, lactose and dextrine, and fails to produce acid with saccharose, is either *B. diphtheriæ*, or what we would term *B. quasi-diphthericus*, the differentiation between the two being made by the inoculation test. However, the converse does not obtain that all diphtheria bacilli ferment these sugars. In an article just published, Smith of Glasgow throws doubt upon the fermentation of lactose by *B. diphtheriæ*.* Only two out of six of his strains, proved by inoculation to be the Klebs-Loeffler organisms, fermented this sugar. Either Glasgow has a special strain of bacilli, or this laboratory an inactive brand of lactose.

And studying carefully the excellent tables compiled by Hoag, Morse and Mellon, we find ourselves justified in selecting for this group the four sugars employed in this investigation. Had we, that is, employed ten, we cannot see that, judged by the experiences of the above-noted observers, we should have at all materially altered our findings. As it is, the permutations and combinations afforded by four variables, or more truly (including virulence) five, are quite sufficient for all reasonable and practical purposes. Species are not so precisely limited. It is well to bear in mind that the separation of forms of life into genera and species is in its essence at most a convention, a convention instituted for the sake of utility, in order to permit the orderly classification of the forms under review. Among these lower forms of life sharply defined species as such do not exist. When, therefore, a classification becomes so minute that in place of being useful it becomes tiresome, the primary object of the convention is defeated. It is contrary to good sense and good practice to elevate a single variation in the fermentation tests into a specific difference. Within the limits of this group the four sugars selected, together with the results of inoculation, or virulence, afford all the particulars necessary for a sound classification. Even these four, in our opinion, are at most helpful, not

* *Applied Bacteriology*, edited by C. H. Browning, M.D., London, 1918, p. 60.

definitive. Diagnosis, that is, cannot be based upon fermentation tests alone.

Employing these and utilizing the data afforded by the investigations above-mentioned, we recognize the following members of the group:

CLASSIFICATION OF THE MEMBERS OF THE DIPHTHERIA GROUP, BASED UPON CULTURAL CHARACTERS, FERMENTATION TESTS AND PRODUCTION OF ECTOTOXINS

	Dextrose	Lactose	Saccharose	Dextrine	Exotoxins
B. enzymicus (Mellon, 1917).....	+	+	+	+	—
B. diphtheriæ (Klebs-Loeffler, 1887)...	+	+	—	+	+
B. quasi-diphthericus (the authors)....	+	+	—	+	—
B. hoagii (Morse, 912).....	+	$\overline{+}$	$\underline{+}$	$\overline{+}$	—
B. xerosis (Kuschbert & Neisser, 1884).	+	—	+	—	—
B. flavidus (Morse, 1912).....	+	—	—	—	—
B. ruedigeri (Mellon, 1917).....	—	—	—	—	+
B. hofmanni (? Park & Beebe, 1895)..	—	—	—	—	—

Morphologically all the organisms here noted have the peculiar features of the diphtheria bacillus, and may on first sight be mistaken for it. There are a few forms on record which may be mistaken for *B. diphtheriæ*, but ferment sugars with the production of gas. These we do not regard as diphtheroids, but as members of the proteus group, nearly allied. The characteristics of the various sub-groups or species are as follows:

B. enzymicus.—So-called from the strong tendency exhibited to ferment sugars with the production of acid. All the members of the group ferment at least six of the saccharides employed commonly in bacteriological research; some ferment as many as ten. Growth poor when first isolated; individuals vary greatly in size and appearance.

Included in this group are the strains (*B. hodgkini*) isolated by Bunting and others from cases of Hodgkin's disease.

B. diphtheriæ, cultures greyish white, with no pigment production, slightly moist; characteristics so well known that they need not here be recapitulated.

B. quasi-diphthericus.—The separation off of this sub-group is necessitated by the consideration that bacilli which do not cause diphtheria cannot be spoken of as diphtheria bacilli until it is

shown that they are *potential* diphtheria bacilli, that by passage, etc., they can be made to produce ectotoxins. Until this has been done they must be treated as distinct. In every other respect they are not distinguishable from *B. diphtheriæ*.

B. xerosis forms on blood serum agar whitish or colourles: colonies, dry and adherent, growing not very actively, and consists ing of large rather thick individuals with clear-cut segmentations-Neisser's granules large and irregular. Common upon the conjunctiva. Does not ferment lactose or dextrine. There has been considerable confusion regarding forms described under this heading. Mellon, from the study of one strain only, describes it as negative to saccharose, while Hamilton includes a maltose fermenter under this name which Mellon would class as *B. flavidus*. That here given is the more commonly accepted sugar formula, though acid is produced so slowly with dextrose that earlier observers reported the fermentation to be negative. Eyre isolated a form from cases of chalazion which he found pathogenic for guinea-pigs, causing local œdema on inoculation. Other observers find it devoid of virulence, and it does not produce ectotoxins.

B. flavidus.—Morphologically and culturally very similar to the preceding, save that with age *the colonies become pale yellow*. Dry adherent growths on blood and serum media. Neisser's granules large and irregular. While not producing ectotoxins, Hamilton found it pathogenic for guinea-pigs (four out of seven strains). Mellon would give this name to organisms "similar in most respects to the Klebs-Loeffler bacillus, but lacking the specific toxin formation of the latter." Morse lays stress on the fact that, unlike *B. diphtheriæ*, it is a weak fermenter, and that "usually" saccharose, maltose and glycerine are not fermented.

The observations of Captain Adams at Folkestone that the strains isolated there, while giving the sugar formula of *B. xerosis*, nevertheless assumed the yellowish colour which is associated with *B. flavidus*, suggest strongly that Hamilton is correct in admitting a considerable variation in the fermentative activities of the former. But in that case *B. flavidus* as such becomes non-existent, save as a variant of the earlier named *B. xerosis*, and all come under the one heading of *B. xerosis*. We are not prepared to make a decisive ruling on this point, and hence, provisionally, record both forms, although registering an opinion that *B. xerosis*, *B. flavidus* and *B. hoagii* form a closely allied series of forms.

B. hoagii.—Under this heading it appears proper to include a very widely distributed group of non-pathogenic diphtherodis

growing actively on blood media, and giving abundant moist confluent growths which take on a *salmon-pink or tawny colour, becoming buff with age*. They vary in their fermentative activities; in general ferment saccharose actively, and do not ferment lactose and dextrine. Maltose at times fermented, at times not. Individual bacilli of medium size smaller than the members of the two preceding species, but larger than *B. hofmanni*, thick, solid, barred, or wedge-shaped. Neisser's granules abundant but small.

We are of the opinion that Benham's organism* which he obtained from cases of common cold belonged to this group, and not, as Mellon regards it, to the *B. enzymicus* series, and that therefore, by the laws of priority, his name *B. septus* (1906) should be applied to this sub-group, but both Benham and Graham Smith identified their organisms with Cautley's *B. coryzæ segmentosus*, and doing this report fermentative activities so divergent as to create confusion. Hine's skin and urethral diphtheroids are here apparently to be included, the latter fermenting dextrine, the former not.

B. ruedigeri.—Ruediger isolated this organism in 1903. It grows heavily on agar and various media, and causes diffuse clouding of broth. It ferments none of the "sugars," although it decolorizes litmus milk, but this without the production of acid (reduction process). It produces an ectotoxin fatal to guinea-pigs, which is not neutralized by diphtheria antitoxin. Rare.

B. hofmanni.—Small, solid, wedge-shaped forms, smaller than *B. diphtheriæ*. No Neisser's granules. Growths colourless. Ferments none of the sugars. Non-toxic.

This table and these descriptions are, we admit, provisional. More has still to be accomplished in the matter of reciprocal agglutination and complement fixation tests before the relationships by these various sub-groups is clearly determined. We give the table tentatively in the hope that it may be of service to others and form the basis for further work.

Comparing this with the table already given of our results, it will be seen that our Wound Diphtheroids (I) come under the category of *B. enzymicus*, our Wound Diphtheroids (II) are *B. hoagii*, and our Wound Diphtheroids (III) are *B. xerosis*.

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* *British Med. Journ.*, 1906, i, 1023.

Conclusions

1. Morphologically, and in the early stages, culturally, diphtheroid bacilli from wounds are, many of them, indistinguishable from *B. diphtheriæ*.

2. Harmless, non-toxic bacilli may be present in wounds affording cultures possessing the same sugar formula as regards dextrose, lactose, saccharose and dextrine, as does the true virulent Klebs-Loeffler bacillus.

3. It is not justifiable, therefore, to make a diagnosis of diphtherial infection of wounds, either from smears alone or from stained preparations and cultural characteristics.* The demonstration that the bacilli produce toxins—ectotoxins—*i.e.*, the result of inoculation of both cultures, is alone capable of proving the presence of infection by the true virulent *B. diphtheriæ*.

4. By the staining, cultural and fermentation tests, four cases of apparent diphtherial infection have been detected in a careful bacteriological study of three hundred and six cases of open wounds. By the decisive test of inoculation these are reduced to two.

5. There is a large body of evidence showing that even isolated cases of diphtherial infection of wounds are distinctly uncommon among the wounded overseas, and complete absence of any evidence in Great Britain that these isolated cases have acted as foci for the spread of the infection to other wounded men. No evidence of a widespread infection of open wounds by diphtheria bacilli has been discovered in Canadian hospitals overseas in Great Britain.

6. Diphtheroid bacilli of various orders, while not common, are, as might be expected, more frequent in open wounds. There is no evidence that these have exerted deleterious effects.

7. There is a certain amount of evidence that particular species of diphtheroid bacilli characterize particular hospitals.

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* *E.g.*, advice has been received from Canada that a bacteriological examination of the wounds of returned invalids at the time of their leaving the hospital ship on January 10th, 1918, before any of the wounds had been dressed on shore, revealed the presence of "bacteria similar to diphtheria bacilli" in fourteen cases. Further information is promised regarding these cases. The wording of the information indicates that inoculation tests had not at that time been performed.

THE CANCER PROBLEM

By C. H. Mayo, M.D.

Rochester, Minnesota

THROUGH the study of comparative anatomy and embryology the anomalies of life have only recently become easier of explanation. It is shown that each life higher in the scale of evolution is subject to anomalies such as would be normal to some life lower in the scale. Certain additional forms accompany the changes from invertebrate to vertebrate. Within these two groups may be found the explanation for most of the anomalies, the cause in some being a chemical one—a change in the salts of the amniotic fluid, or of the solution in which the egg is developed. Is it not possible that the cancer problem may in time be worked out in all its details on the basis of primitive life? In fact, we advance far by the harmonious assembling of facts made known by many observers and writers.

Unicellular life of both animal and plant type divides the cell and with it the cell intelligence for type and habits. We find that microbes may be changed from one to another of the same species by change in the oxygen tension, showing that variations of these organisms may occur with but little change from natural conditions. The polar bodies, centrosomes, and chromosomes do not occur in the unicellular organisms as found in the cells of multicellular organisms, and while unicellular growth is parasitic, increasing as long as food can be obtained and environment permits, in multicellular life each cell must be controlled for community existence and harmony of work, and the controlling agents are the chromosomes and centrosomes. Probably the centrosome represents the dynamic power as suggested by Wilson.* Cancer is created in some manner by the division of one cell failing to carry with it the

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* Wilson, E. B.: "The cell in development and inheritance." New York, Macmillan, 1911, 483 pp.

centrosome, the next division leaves it without control as a unicellular type of life capable of lawless growth more or less true to type but without a controlling brain. In reversion of type, the cell becomes parasitic in existence, creating nests of cells, fungating growth, ulceration and degeneration or connective tissue, according to the location, tissue and blood supply and reaction to irritation, and primarily changing the local field into a slightly acid one as an environment suitable for its growth. Ultimately this fluid permeates the body, a curious cancer cachexia occurs and with it there may be metastases later becoming manifest by growth at any point where cells may be carried. Before this it occurs in adjacent local lymph glands permeated by the fluid, and cancer grows freely in them. It is this need for proper chemical fluid environment that explains why cancer cannot be transmitted into higher types of life, but can be transmitted in the lower. This explains the metastases occurring in cachexia, the whole body being in an acceptable fluid state.

Cancer continues to be one of the greatest of modern scourges. The disease apparently is on the increase, especially among the more highly civilized races. It may possibly be more prevalent than is suspected among lower types of the human race because of lack of examination and investigation, as has been shown to be the case in cancer of animals such as water buffalo, dogs, chickens and mice and the lower types of life. In this connexion, Erwin Smith's work on cancer in plant life is of great interest, He has shown many plant tumors as being due to bacteria and insect irritation, and he has been able to reproduce and transplant certain tumors which compare in malignancy with those of animal cells. He also predicts almost the localizing of the cancer by use of certain irritants injected with the cancer cells.

In cancer there is a local lawless cell growth. There must be, then, either a local cell fertilizing agent or a local loss of control over cell growth, and the study becomes one of the individual cell, the actions of which are best observed in early cell life. After maturity is reached, there are few structures capable of cell growth, yet the thyroid, a dynamic organ controlling energy output, is subject to hyperplasia, the liver, a most necessary organ, is subject to regenerative growth.

Discussion, investigation and discovery have been the means of controlling other great life-destroying diseases and have been most helpful in the control of cancer. Statistics show a marvellous improvement in the control and care of tuberculosis, and of pneu-

monia, while cancer, apoplexy, nephritis, and diseases of the heart have all been increasing. The greatest advance, however, in our knowledge of disease has come from a study of the individual cell. MacCarty's investigations tend to show that the disease begins in the waiting or immature repair cells, which replace the active or protective epithelium of the secreting cells, and not in the mature cells. The necessity for over-activity of these resting cells by the stimulation of continued traumatism and the destruction of mature cells may be an important factor in the local origin of cancer. Thus rapid development and lack of control with migratory hyperplasia would place such cells within the cancer classification. The cell's intelligence for growth carries on progressive activity; the half of each active cell becomes the new cell continuing its intelligence. Some investigators believe that a fertilizing agent of nucleated cells gains entrance to local areas through traumatism, and should a single cell become fertilized, cancer may develop. It is believed by some that the fertilizing agent of a cell is water-borne, and with some stretch of the imagination we bridge provoking difficulties of type, form and location in a study of the cause of cancer. The biochemic theories of cell development are also advanced. The effect of cholesterol on the cell is being investigated. Educational propaganda has been of incalculable value in the prevention of cancer by early treatment, by the removal of benign tumors, and by the avoidance of irritation. It is probable that there are continually two hundred thousand people in this country suffering from the disease, and approximately eighty thousand die each year of the disease.

While cancer may be found at any age, it does not commonly occur in persons under thirty-five years and it rarely occurs in persons under twenty years, when natural cell activity might be presumed to be a factor, and its disturbance would more readily develop uncontrolled growth. The resistent influence of youth may lie in the rapid reduction and restoration to normal of the acidity necessary to remove the ashes and waste developed in cell activity, and young cells have not exhausted the protoplasmic control bodies. In old age with hardening of the tissues, it is easier for a centrosome to be immature in its development and it may wholly fail. If it is immature, we have the skin changes, and, in the old precancerous conditions, becoming cancerous when one cell utterly fails in its control. Thus cancer would originate in one cell reverting to primitive life. The chemical change is naturally much slower in degenerating tissue or in the normal degeneration of advancing age.

In considering this chemical theory of cancer as influencing vicious cell growth, it is noted that one-third of the cancers affecting man, 38 per cent. in men and 22 per cent. in women, are found where acidity is constant and high, as compared with other tissues such as in the stomach. In ulcer, the gastric secretion is high in free acid. When cancer develops, combined acids increase and free acid diminishes or disappears, and the activity of pepsin is reduced or destroyed, regardless of the presence of combined acids. In accordance with this hypothesis peptic ulcer and cancer would occur but rarely in the non-acid achlorhydric stomach, since destructive growths and destructive bacteria are most harmful in the acid environment. The duodenum, which by right of continuity of tissue and close association, and opportunity for grafting from cancer in the stomach, is far more commonly affected by ulceration than is the stomach, but it is rarely affected by cancer, which, nevertheless, may spread from the stomach into all other tissues and structures surrounding it and at distant points in the abdomen. Ulcers occur in the stomach about one third as frequently as in the first portion of the duodenum. A large percentage of gastric cancers give a history of preceding ulcer. Ulcer, then, is more common in the naturally alkaline duodenum, which is periodically bathed with the acids from the stomach. The neutralizing process occurs in the first portion of the duodenum. Ulcer or cancer is very rare in the duodenum below the first two or three inches, although cancer occasionally occurs in this organ by penetrating through a duct. Cancer occurs but two times in the whole length of the alkaline small intestine to ninety-eight times in the large bowel. The colon is frequently affected by cancer because here again there is acidity, and 75 per cent. of cancers are located in the fixed and tissue-surrounded portion of the colon, which retains the dry and harder contents as a traumatic agent. The same statement may be made concerning the development of cancer in other fields, either normal or degenerative, that is, the urinary bladder, the cervix and the mouth. The mammary gland, the uterus and the prostate are subject to carcinoma, being tissues in which degeneration is a normal process and having but a limited period of functional activity.

Ulceration, under proper conditions, may permit cancer to develop. The ulcerative process itself is usually of bacterial origin, and the bacteria are carried by the circulation, local conditions of infection being developed through capillary infarctions. It is very probable that the essential factor in the development of carcinoma is a derangement inside of the single cell, in an acid field and that

the single cell carried through the lymphatics or into the circulation is the cause of metastasis. In the peritoneum and on the surface, grafting is common and it is occasionally seen in epithelial and mucous surfaces.

It is evident that cancer is on the increase among the more highly civilized people; the enormous percentage occurring in the stomach would indicate that this organ receives the greatest abuse. Many factors concerned with the higher civilized existence probably tend to the increase of cancer and should be a subject for study.

We have then in cancer a cell with lost control, destroying its community existence and reverting back to primitive life. It has a natural acid environment or an acquired one incident to local degeneration which may be normal, as in the stomach, or incident to normal degeneration as in the breast and uterus, or the degeneration of age.

The part played by chronic traumatism or irritation in the development of cancer is positive and definite to a degree. The danger of cancer is increased by all irritation or traumatism which demands a continued cell repair and it is in proportion to that demand. Ultimately exhaustion of cell control bodies occurs, modified by age limitations and chemical surroundings. Such areas offer an increasing opportunity for the half of a dividing cell to revert to the unicellular outlaw type of life and to become parasitic and cancerous.

If the cells are involved they must be of the immature or waiting type, and further progress in the study of cancer can come only through a study of the individual cell of the multicellular and unicellular organisms, in order to select more definitely the one or more bodies which may be involved in the control of its protoplasm.

Treatment

Removal by any method is effective, if early, whether by knife, paste, cautery, rays or radium. Removal of the local growth is not effective if the glands are involved, more extensive dissection being required in addition to gland removal.

The effect of rays may be to lower the permanency of the control bodies of the cell; thus prolonged *x*-ray treatment without protective shields, for certain types of rays, adds a factor of danger in the production of cancer.

THE SOCIOLOGIC AND ECONOMIC ASPECTS OF TUBERCULOSIS

By J. S. Wright, M.D.

Edmonton, Alberta

THE Armegeddon that has been convulsing Europe for the past three years, and that has drawn this country into its vortex, has, I fear, temporarily withdrawn the minds of people from the ever-present ravages of tuberculosis, and that at a time when the people of this Dominion should be facing the problem with greater vigour and vigilance than ever, because of the increased demands that will be made upon our efforts and resources with the return of the armies from overseas. It is true that the Hospital Commission has anticipated this demand, and has made certain provisions to meet it, but this in no way affects the cases in civil life at present with us, nor those that will seek homes in this country after the war.

The average citizen is appalled at the terrible destruction of life on the battlefields of to-day, and, indeed, would be a callous individual were he not so moved, but the same citizen gives but a passing glance at, or makes but a casual remark about, the destruction of life by this terrible plague, and passes on, oblivious to the fact that it destroys more lives every decade than the bloodiest wars have ever done. The very frequency of such destruction of life, and the distress accompanying it, has dulled our sensibility in estimating the destructive forces, and benumbed our sense of responsibility in the prosecution of this war that will still be with us when the present European strife will have become ancient history.

The sociologic and economic aspect of this question is far-reaching, ramifying as it does into every phase of the social and industrial life of the nation, embracing alike the factory and the home; the office and the college; the mansion of the wealthy and the cottage of the poor; insidiously attacking the workman at his bench; the accountant at his desk; the student in his classes; and the indi-

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vidual of leisure, surrounded by all the luxuries of the modern homes of the wealthy.

Nor is any age of mankind immune. It may attack the infant not yet released from its mother's arms; the child at play, the youth in the school; the adult in the prime of life and busy with life's vocations; or the aged, who, after the activities of life, look forward to some years of leisure before the final summons.

The last quarter of a century has thrown light upon much the nature of the infection, and has placed it positively in the list of communicable diseases, but it has also placed it positively in the list of preventable diseases. The fact that the nature of the infection is known has, *per se*, supplied us with knowledge how to escape that infection.

Notwithstanding all this, the indifference with which the general public regard this plague is appalling. Where, then, lies the responsibility for this attitude. We certainly cannot place it upon the shoulders of the members of the medical profession, who have done such titanic work in endeavouring to arouse the public mind to a true appreciation of the causes and effects of this dread disease, but that their effort has not met with a full measure of success is only too apparent, if we but glance at the health reports of our cities and provinces.

Neither can we lay the responsibility at the door of that splendid body of men and women who banded themselves into the Society for the Prevention and Cure of Tuberculosis, and who, by the sacrifice of time and money, have carried on a campaign of education along these lines. Their efforts, like those of the medical profession, have not met with a full measure of success; but who would presume to place an estimate upon what these two bodies have already done, or to say what the future results will be?

The responsibility I lay, and that without hesitation, primarily, at the door of the State, and secondly, at the indifference of the public.

No expenditure of public funds, if wisely made, will yield such dividends as that expended on public health; dividends of actual cash, because with the maximum degree of public health co-exists the maximum degree of industrial efficiency; and what is of still greater value is the dividend of contentment and happiness in the individual and the home.

From the dollar viewpoint alone, let us glance at the monetary cost, annually, to the Dominion from tuberculosis.

Dr. Bryce, in his address to the Canadian Association for the

Prevention of Tuberculosis, meeting in the city of Quebec, 1916, made the statement that ten thousand died annually from tuberculosis in Canada. Placing the value of the individual to the State at $5,000 (and this seems to be the value placed upon the life of the individual by the courts), means an actual loss to the country of fifty millions annually.

Nor is this all. With every ten thousand that die from the disease, one hundred thousand are afflicted with it. From statistics that I will quote later, this means a further loss annually of forty-five millions of dollars, placing the average earning capacity of the individual, between the ages of twenty and sixty, at $2.00 per day—a very low average. Nor is this all. The one hundred thousand sick must be cared for, and that cannot be done without actual dollars. The cost per patient, per day, cared for in the hospitals of Canada, varies from about $1.50 to over $2.00. Taking the lowest figure, we have another fifty millions, annually, actually lost to the Dominion of Canada from this disease alone. These figures are appalling, and you know, gentlemen, that figures cannot lie, although some liars may figure, but the writer denies any relation, whatever, with the Ananias Club.

According to the Bertillon Classification, one thousand deaths from tuberculosis are divided, per age, as follows:

From 1 to 20 years, number of deaths	184
From 21 to 40 years, number of deaths	448
From 41 to 60 years, number of deaths	313
From 61 years and over, number of deaths	55

Or twenty to sixty years—76·1 per cent.

Children and youths to the age of twenty are, generally speaking, non-producers, and are dependent either upon the state, their guardians, or their parents for their upbringing and education, but these same persons, during the next two decades, are the producers, both of national wealth and of the species, and cannot be eliminated without loss to the state. The next two decades, from twenty to forty, is the period of life in which the species is being reproduced. During this period, 44·8 per cent. of all deaths from tuberculosis occurs, and over 90 per cent. of all children are born from parents between these ages.

The Bertillon Classification corresponds very closely with the vital statistics of the various provinces of the Dominion.

In the province of Alberta, the death-rate between the ages of twenty-five and forty-four inclusive, in 1915, was 40·8 per cent.

of the total death-rate from tuberculosis, and the total deaths in the same year from the disease was 8.5 per cent. of the total death rate of the province. These percentages speak for themselves and constitute an eloquent plea for a renewal of our efforts, or, rather, a renewed determination in prosecuting the war against the disease.

Until the present, the burden of this fight has been borne by but two bodies, the medical profession and the Association for the Prevention of Tuberculosis. It is true that the efforts of these two bodies have not yet reached the pinnacle of their aspirations, but it is, nevertheless, true that their course is ever upward, and that the true estimate of what has already been done is a matter of the future and not of the present. Has the time not arrived when this burden should be shared by the higher authorities. The Dominion Government and the governments of the different provinces have a responsibility in this matter that has been too long shirked. It is true that from time to time different measures have been enacted both by the Dominion and provincial bodies which have helped very materially in prosecuting this fight, and that certain monetary assistance has been given, but with these apparently their efforts end. This is not as it should be, and until the governments of this country awake to their responsibilities in this matter, the results obtained will be far short of those desired. The sanatorium is now the recognized place for the treatment of this disease, in whatever state, and their existence is amply justified by the results obtained. That these institutions should have to struggle along, dependent upon the generosity of the individual, seems to me to be very wrong indeed. These institutions should be built, equipped and maintained at the public expense, and until this is done the efforts of the Association for the Prevention of Tuberculosis will not have accomplished its purpose—the stamping out of tuberculosis.

A deputation that waited upon our provincial premier and advanced these ideas, was courteously received, but we were plainly told that the government could not see its way clear to act on the suggestion. It was pointed out to us that no other province was undertaking the work.

In the province of Alberta, the public health is administered through the Department of Agriculture, and takes second place to the killing of noxious weeds and gophers, to the health and happiness of our horses, our cattle, our hopes, and even of our hens. Should any of these be sick, a paid provincial veterinarian will travel the length and breadth of the land to see them and cure their ills. But the poor man or woman afflicted with tuberculosis, or,

in fact, any other disease, must pay for advice or go without it, unless it be that some physician, out of kindness, renders such aid, which usually occurs.

If the figures quoted be correct, and they are assuredly reasonable, does it not appeal to you as exceedingly poor business that this loss should occur annually, when a percentage of the annual loss expended in the construction and maintenance of a series of sanatoria, extending from the Atlantic to the Pacific, would ultimately wipe out the loss and place the figures on the other side of the ledger.

Further, such a series of sanatoria maintained by the Dominion and provincial governments, co-operatng on some plan that could easily be worked out, would give much more efficient control of existing cases, which is so necessary in the extermination of the disease. Then there could be a rigid segregation of all individuals that are a menace to others. These cases would become the guests of the government until they were either dead or better, and in the meantime would be prevented from passing the disease on to others. Personally, I have held very positive opinions on this phase of the question for a number of years, and believe that the disease will never be exterminated so long as sentiment influences our operations.

In Ontario, at the beginning of the present century, when there were no special facilities for the care of tuberculosis patients, they had a death-rate of 1·4 per thousand. In the year 1900, the Anti-Tuberculosis Society was organized, and in the fourteen years following, when their sanatoria accommodation had increased from none to twelve hundred beds, their death-rate per thousand fell to 8 per cent., the lowest rate of any of the provinces. These figures are significant in establishing a ratio between efficient and sufficient sanatorium accommodation and the death rate from tuberculosis.

This, then, should be sufficient plea for great sanatorium accommodation, and sufficient reason for the Anti-Tuberculosis Association and the medical profession persisting in their pressing upon the Dominion and provincial governments their obligations and responsibilities in the matter, and not slackening in our demands until we see a string of sanatoria from Prince Edward Island to British Columbia, state-owned and state-operated, in which those unfortunates may find a haven without being a worry to themselves and a burden to their friends.

This association and the medical profession throughout the civilized world, possess a power to-day that it has never held before in the history of medicine.

The man behind the man behind the throne—Lord Northcliff—made the sweeping statement that, at the beginning of the war, the only department of the service that was up to its maximum degree of efficiency was the Army Medical Corps, and this fact has been growing and sinking into the public mind more and more as the war progresses. The profession is coming into its own, and to-day can be, and should be, a large factor in moulding public opinion especially in matters of public health.

Governments are but the expression of public opinion—and as such are not beyond the sphere of influence of the profession.

Let the legislative committee of this association see to it that a department of public health—Dominion wide—is organized and made a part of the government, with a commissioner at its head, who shall be a recognized authority on matters of public health and sanitation. This department should be placed above party politics and established on such a basis that the political boss, or ward politician, could not interfere with the commissioner in carrying on the work of his department.

Let the legislative committee of the different provincial societies see to it that a similar plan is worked out for each province, and the administration of the health laws is taken out of some other department where they are but a side, issue, and raised to the dignity of a department of the government, with a commissioner of health at the head, with similar qualifications and holding office under the same conditions as suggested for the Dominion government. These heads of departments, together with the medical health officers of the cities and towns, meeting annually, would exercise a tremendous influence on public opinion, would speak with authority on matters of health, and, I venture to say, would soon justify their existence by the results obtained.

THE RETURNED SOLDIER

By W. T. Connell, *Lieut.-Col., A.M.C.*

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THIS paper deals only with certain aspects of the problems of the soldier, rendered ineffective by wounds, injury, or disease, and now being returned to this country.

Such men fall into two main groups: (1) those returned whose medical treatment is complete, but whose disabilities are such that they are deemed to be ineffective for duty at the front or on lines of communication. Such men are returned and, if needed and suitable, are retained for base duty in Special Service companies; if not needed, they are sent before a medical board, disabilities graded and men discharged to civil life. (2) Those returned who still require more or less medical treatment. This is the group with which we have to deal in hospital work in this country and with whose problems I am familiar. Roughly we divide these cases into cot and convalescent groups. The former constitute those cases of crippling injuries, or disease severe enough to make the recumbent position desirable. So far these cases constitute from one fifth to one fourth of our population. They differ only in the severity of their disability from the convalescent group and on this account have to be detained in hospital on arrival in Canada. The convalescent or walk ing cases are all naturally anxious to get to their homes and see their families. On admission these men are at once submitted to an examination and all those who will take no harm are granted two weeks' home leave. Applications for extension of leave are of course frequent, but are only given in special cases. On return to hospital these men are re-examined, a case history sheet written up to date, and the man is referred to medical, surgical or specialist consultant, as his case may require, and treatment outlined is put into effect.

Surgical Cases. Thus, if the case is a surgical one, the consultant looks the patient over with the medical officer and outlines procedure. Such a man usually requires an *x*-ray examination and

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may need some remedial operation, a special boot or mechanical appliance, remedial exercise, massage, or physio-therapeutical treatment, and these a convalescent hospital should be in a position to furnish. The operative work required is of heterogenous nature, but consists mainly in the removal of portions of dead bone or other foreign material, including shrapnel, the curettement of sinuses, tendon transplantation, an occasional bone plating, a larger number of bone grafting operations, a few osteotomies, and considerable plaster work. Major operations are occasionally necessary, such as amputations, or re-amputations, cystotomy for stone, appendix operations, etc. The services of a surgeon with a fairly good orthopædic knowledge is thus very essential. A first-class *x*-ray equipment and operator is an absolute essential and these we are fortunate in having.

Our hospital has two shoemakers to make special boots, pads, binders and belts and to line braces and mechanical appliances. We have been fortunate in securing the services of a shoemaker with considerable experience in this line of work, and who can readily follow specifications, and thus his work is proving very satisfactory. A machinist makes the necessary mechanical appliances on our specifications; as he has been able to use the University workshops, we have been spared the expense of equipment.

We have utilized the services of the physical instructor attached to this hospital for the carrying out of special remedial exercises. A course of exercises is devised for each case where muscles require development and in which there is pseudo-ankylosis from fibrous thickening, or from disuse. These exercises are graded and have been of great advantage in many cases. This work is a very promising field in the case of men whose disabilities are much exaggerated by disuse of limbs, or muscle groups, and who require re-education.

Massage and passive movements are extensively employed and we have a staff of five masseuses employed. As a preliminary to physical exercises, massage is a very valuable procedure. It can also be employed to advantage in many of the bed cases, where remedial exercises are not possible. Our hospital has, too, most of the usual electrical appliances. Under the direction of Major Quigley these are now being much used. Personally I cannot speak of the indications for their employment except the use of high frequency currents to lessen the pain of hypersensitive tissues such as result from irritation of nerves caught in scars, etc. We are using, too, quite freely various apparatus for the local application of heat, especially in myalgias and chronic rheumatism. On these I

cannot yet express a definite opinion as to their field of usefulness.

We are not equipped to supply artificial limbs, or special orthopædic apparatus, nor have we attempted to do arthroplasties for bony ankylosis of the large joints. All such cases are transerred to the Special Orthopædic Hospital, Toronto.

Medical Cases. In a similar way on the medical side the patient, after examination, is placed on special medicine, diet, massage, etc. We have had a considerable number of cases returned with persistent albuminuria, following trench nephritis. Under the functional nephritic test very few of these cases show any damage to the general functional capacity of the kidneys. We are continuing our observations on these cases and hope to get more extensive data on which to base conclusions.

A fair number, too, of cases with persistent bronchitis are returned. In younger subjects many of these (with no history of gassing), are cases with a tuberculous basis. As a rule these cases respond quickly to treatment in this climate. Any definitely tubercular case is at once transferred to the sanitorium and passes from our care. In men over forty the response to treatment is poor, as the lungs are usually emphysematous.

Shell Shock and Neurasthenia. A certain number of these cases are returned. As a class they are not suitable for treatment in a general hospital, but require special care and treatment. It has been our practice to clear all, except the lighter cases, to the Cobourg Military Hospital, which is staffed and equipped to deal with this class of cases. A a rule these cases clear up in time, but are certainly unfitted for further military service, except in clerical or light orderly duties. They do much better in civilian life, as there can be no question that the fear of return to active service militates strongly against recovery.

The bacteriologist looks after the Wassermann reactions, special bacteriological blood and urine examinations and the manufacture of autogenous vaccines. The medical officers of wards are responsible for the simple laboratory procedures as blood and urine analyses.

All eye, ear and throat cases receive the attention of a specialist, and glasses, artificial eyes, etc., are supplied on his prescription.

Sooner or later, the man reaches the stage when it is considered that further treatment will not be of advantage to him. The medical officer in charge of the man then writes up his case on M. F. B. 227, laying stress on the description of the present disability of the patient in so far as function is concerned. This description

should be a fair guage of the incapacity of the man to carry on work, not as based on his previous employment but on the extent to which the man is incapacitated in the common labour market. The medical board in turn examine the man, place him in a medical category and submit their opinion on the disposition of the man.

Medical Boards. Up to recent date the medical officers have given a percentage estimation of the extent to which a man was disabled based on the instructions and table of incapacities laid down by Board of Pension Commissioners. Recently the Board of Pension Commissioners have issued new instructions which take away this duty from the Medical Board. The following extracts are given from such recent instructions:

"The Board of Pension Commissioners represents that difficulty has arisen in certain cases by reason of a difference of opinion between the medical officers of the Pension Board and the Medical Boards preparing M. F. B. 227 in the districts, with reference to the percentage of disability resulting, in the opinion of the medical board, from the present disability and condition of the man who has been examined. The Board of Pension Commissioners comment as follows upon the situation:

"This board has a very competent staff of medical officers whose main duty it has been, ever since the organization of this board, to estimate disabilities and establish medical precedents. The standing medical boards, on the other hand, have, in general, not been mainly occupied with estimating disabilities and, furthermore, they have not had sufficient experience of disabilities to be able to establish medical precedents. It is true that the unification of estimates has been partially secured by the issuance to the standing medical boards of the Board of Pension Commissioners 'Instructions and table of disabilities for the guidance of physicians and surgeons making medical examinations for pension purposes'. It would appear, however, that in all those cases where any great range of estimates is possible no unification of estimates has been secured. For example, one board will estimate the percentage of a disability at as much as 75 per cent., while another board, in a different town, will estimate the same disability at 10 per cent.

"It is the description of the disability and not the estimate of its percentage which mainly interests the Board of Pension Commissioners. If the description of the disability warrants only a 30 per cent. and the estimate of the disability is 50 per cent., a 30 per cent. pension only will be awarded. In other words, the estimate made by the standing medical board merely acts as a check on their

description of a disability and as a possible check on the estimate to be given by the Board of Pension Commissioners. The estimate of the standing medical board is only an opinion. The estimate of the Board of Pension Commissioners is a decision.

"All reference, therefore, to estimates of the percentage of disability are to be omitted in future, and the medical officer bringing forward the case and the medical board examining for discharge will be instructed to this effect, and required to concentrate upon giving the fullest possible description of the history and present condition of the man."

Now the comments of the Board of Pension Commissioners are of course wide open to criticism. The most obvious, when one is dealing with the case of a man examined and presented by a competent Medical Board, is that the Board of Pension Commissioners is of the opinion that its medical officers are more competent to estimate disability from the written evidence than is a medical board from the evidence and from the facts elicited from the presence and the examination of the case. In other words, the claim is made that the picture painted by the medical officers on the medical board can be better interpreted by the officers of the Board of Pension Commissioners than by the men who painted the picture and had the copy before them. Our medical officers on boards will have to burnish up their descriptive powers so that the picture painted will be vividly presented to these judges.

Our experience is that these judges make mistakes like their confrères on the judicial bench, or ordinary mortals. Of course, however, such decisions are not like the laws of the Medes and Persians, but are subject to review at the end of six and twelve months and yearly thereafter, so that sooner or later, justice is done.

On completion of the Board, papers are forwarded to the A.D. M.S. of the district for approval, thence to District Dépôt (Casualties) for completion of discharge and to Board of Pension Commissioners for pension. Discharge is usually effected in about two weeks, which is of course too short a period for the Pension Commissioners to announce their decision. The man, however, suffers no financial disability, as he is paid at army rates for three months after discharge (post-discharge pay). This, too, affords ample time for the Pension Commissioners to reach a decision and put the man on pension.

Now the medical officers in charge of hospitals are not made acquainted with the decisions of the Commissioners, hence we never know the extent to which our views and those of the medical board

are carried into effect. We are thus not given the opportunity to learn anything from such decisions for future guidance, Many of the men who are dissatisfied with the decisions naturally enough lay the blame on the medical board, believing that they understated or underestimated their disabilities, and thus we not infrequently get blame which we do not deserve.

As to the men themselves, in their relationship as patients, I have but to say that the vast majority can be classed as good patients, co-operating with doctor and nurse and doing all in their power to help themselves on the road to recovery. A few, not over 10 per cent., are grousers, complaining of the line of treatment or the lack of it; or stating how much better it was done somewhere else. As a rule, the men who complain most, deserve least consideration, on the basis of service rendered the country. In this class, too, are comprised those who stir up the sympathies of the sentimentalists found in every community and these, in turn, do not make the lives of officials any easier. Of course these sentimentalists do keep medical officers and other officials attentive to their duties, by calling attention to any apparent dereliction of duty. We object most strenuously to that class of sentimentalist who encourage in those who don't need such encouragement the view that the country owes him a living for the future. Public sentiment in this regard is in a healthier state now than a year ago, and I think continued improvement in this regard can be expected. Public sentiment rightly demands that the returned man should receive fair and generous treatment, and this I think is the attitude taken by practically all medical officers.

One source of trouble, both to hospital officers and no doubt to Headquarters' officials as well, are the certificates given by kindly family physicians. Such men too often, out of goodness of heart, sign statements which some investigation on their part would show were, if not erroneous, decidedly misleading. (Several local examples, in which prominent physicians have signed statements which a little more care on their part would have shown were contrary to the facts, were quoted.) I would ask physicians to remember that most medical officers in charge of soldiers have the interests of these men quite as much at heart, as the physician has for his patients—in ordinary practice.

What steps can be taken should a discharged man develop later a disability, traceable to service? In such a case the practice heretofore was that such a man could appeal to the A.D.M.S. for examination and investigation of his case. If the facts warranted

it, such a man is re-attested for purposes of treatment and sent into hospital. As matters stand now, this duty of re-attestation and treatment of discharged men will be assumed by the Invalided Soldiers' Commission. Any deserving case is sure of proper consideration and care.

There is another phase of the returned soldier problem that is of great economic importance, viz.: the question of vocational training. This is particularly important in the case of men whose disabilities are such that they will be unable to again take up the work in which they were engaged before enlistment. A certain number of men during their convalescence are fitted to take up such training and when it has not interfered with treatment we have encouraged such. Naturally we think the restoration to health takes first place. Up to the present time the courses available locally, apart from motor mechanics, have been largely "book-work", covering commercial and civil service courses, with improvement courses in primary education. No attempt has been made by the Vocational Staff to develop the therapeutic workshop idea, or to co-operate with us in this line of work. In consequence, we have had to substitute special exercises under the physical instructor, with supervision by the medical officers. After discharge, of course, a man can take up vocational work directly under control of the vocational staff. The principle is an excellent one and needs development on business lines.

Venereal Problem. Among the people of this country there seems to be a widespread opinion that venereal disease constitutes one of the main problems of the army in general, and returned men in particular. It is true that these diseases are prevalent in the army, but not to any greater extent than in the civilian population. In the army the ineffectiveness caused by these diseases is made manifest, the cases are discovered and subjected to treatment and the hospital returns show their prevalence. In civilian life infected individuals' working inefficiency is covered by "absence through illness"—no statistics are available as to its exact prevalence, and no systematic treatment is enforced. In fact, the great reservoir of infection is the civilian population. One gets a good idea of its prevalence from the results of examination of the draftees under the Military Service Act. When these men were called up and subjected to examination on reporting to their dépôt, the venereal hospital became filled to overflowing and its capacity had to be more than doubled. Venereal diseases are a civilian problem more than an army one. In fact, as far as the returned man is concerned, there

is no such problem. All men before leaving England are examined and certified to be free from such disease. On return, if a man has had a history of venereal disease on his medical history sheet, or if there is any indication of syphilis in his clinical history, a Wassermann test is done, and, if necessary, a full course of treatment carried out. As a result returned men will practically be free from venereal infection on discharge, and instead of a menace to the civilian population, will be menaced by the latter.

THE first hospital for American soldiers has been lately opened in Liverpool. All other hospitals in Britain have been for American officers. The hospital is known as American Red Cross military hospital No. 4, and is situated in the Mossley Hill district. Already many American soldiers occupy its cheerful wards. The hospital proper occupies Mossley House, the former home of Dr. Edmund Knowles Muspratt, a noted authority on chemistry, and one of Liverpool's leading citizens, who, when he heard that the Americans wanted it, gladly turned it over to them. The house stands in the centre of seven acres of beautiful grounds, the flowered gardens of which are rapidly being converted into plots of rising vegetables. An American flag, flying from the tall staff in the front of the grounds, points the way to visitors.

The largest American hospital in England will be located at Salisbury. It will accommodate three thousand wounded Americans from the Western front.

THE TREATMENT OF INFECTED WOUNDS WITH DICHLORAMINE-T WITH SPECIAL REFERENCE TO ITS ADVANTAGES OVER THE CARREL-DAKIN METHOD

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THE subject of the treatment of infected wounds is one that has probably excited more interest than any other among the medical profession since the war began. Many methods of treatment have been devised, tried out, and cast aside. Probably no part of our pre-war teaching has changed as much as this question of antiseptics. We formerly used bichloride of mercury, carbolic acid, lysol, boracic, etc., believing more or less that they killed micro-organisms under all conditions, but now we know that they are antiseptics, that is, they inhibit the reproduction of bacteria, but they are not germicides unless used in strong solutions under favourable circumstances. The perfect germicide is one that will destroy bacteria without injuring the body cells. None of the pre-war antiseptics came up to this standard. Dr. H. D. Dakin, probably more than any other, has done much laboratory work in antiseptics, and in general terms he gives us the following results:[1]

Using a growth of staphylococcus aureus in blood serum-muscle extract medium he found that

mercuric chloride, 1-10 per cent., did not disinfect in three hours, but did in twenty-four;

silver nitrate, 1 per cent., did not disinfect in twenty-four hours;

argyrol, 15 per cent., did not disinfect in six hours, but did in twenty-four;

zinc chloride, 3 per cent., did not disinfect in twenty-four hours;

hydrogen peroxide, 2·89 per cent., did not disinfect in twenty-four hours;

phenol, 2 per cent., did not disinfect in twenty-four hours.

Read before the Surgical Section, Academy of Medicine, Toronto, April 16th, 1918.

Dye antiseptics:

malachite green, 0·3 per cent., did not kill in forty-eight hours;

acriflavine, 0.3 per cent., did not kill in six hours, but did in twenty-four.

proflavine, 0·3 per cent., did not kill in twenty-four hours.

So we see that our old favourites are gradually losing their stand.

In the laboratories established at Compeigne by the Rockefeller Foundation in the fall of 1914, Dr. Henry D. Dakin, of New York, examined about two hundred substances known, or thought to be, antiseptics, and finally came to the conclusion that chlorine compounds were the best germicides. Labarraque's solution, known and used for many years, was a very efficient antiseptic, but owing to its high alkalinity causing irritation, it could not be used on the tissues continuously. Dakin reduced this alkalinity with boric acid, and as a result obtained a solution that did not irritate the open tissues. This solution soon became known as "Dakin's Solution". It is an aqueous mixture of sodium hypochlorite between ·45 per cent. and ·50 per cent. in strength. Dr. Alexis Carrel, who was associated with Dakin in his work in France, devised a means of using this solution to the best advantage. The wound was opened widely in such a manner that it formed a well, and small perforated tubes were placed in such positions that the Dakin's solution injected through them would reach every crevice of the wound. These tubes were linked together and from a reservoir suspended above the bed, the solution was run into the wound every two hours, day and night. The results, when all the technique of the treatment is properly carried out, are striking, badly infected wounds being sterilized in a few days. Carrel, Depage and others have reported many cases where wounds of all kinds have been sterilized and secondary suture done with success, but, as Carrel himself says, "The indifferent success that many have had is because of their failure to grasp and apply the details of the technique."

In order to carry out this treatment the assistants must be specially trained. The house surgeon doing the dressings must know the details perfectly; the nurses who assist him and who inject the Dakin's solution every two hours must also be specially trained. All those who have had success with this treatment agree on these points. In a general hospital where the nurses are changed fre-

quently, such a procedure is impossible. Here then is the first place the technique may fall down.

At the Rockefeller Institute, where Carrel is at present training American army surgeons, I spent ten days in their laboratories and wards. The house surgeon, a trained man, had four or five nurses and an orderly to assist him with the dressings. He took about two hours to do fifteen dressings. Considerably more than half of that time was spent in preparing the surrounding skin with vaseline or vaselined gauze in order to prevent irritation. In spite of this preparation I saw several cases where the skin had been more or less "burned" by the solution. Without this care, serious results may obtain. Probably the most important part of the Carrel technique deals with the protection of the skin from the irritation of the solution.

It is essential at the primary operation to prepare the wound so that it will act as a well to hold the antiseptic solution. Thus the first principle of surgery of infections, dependent drainage, is abandoned. If at any time during the repair of the wound, the technique should break down, such as breakage of apparatus or failure in the supply of solution, these wounds act as pus pockets and the results to the patient may be disastrous. Again, when the wound has been sterilized, if it is impracticable to suture it, there is a basin left which fills with pus and, as is well known, many such wounds will not heal as rapidly because there is not dependent or continuous drainage.

Dakin's solution is very unstable. In order that it may be strongly enough antiseptic it must have over ·45 per cent. of active chlorine present, and that it may not irritate the tissues, it must be less than 0·5 per cent. The solution, therefore, must be made accurately and at the most every second day. Moreover, the alkalinity must be reduced almost to neutrality. Owing to instability, this alkalinity tends to increase, and therefore the solution must be tested by titration and phenolphthalein daily. Only those who have done this work and kept a ward supplied with Dakin's solution can realize the time and care it takes.

Another problem that is becoming more important every day is the amount of dressing material used. With the price of gauze and cotton soaring we must do all in our power to save. The Carrel technique needs more cotton pads than any other kind of dressing, because of the quantity of solution that is injected into the wound twelve times a day. Unless the technique is absolutely perfect, there are going to be certain cases where there will be an overflow

resulting in the wetting of the bed, with discomfort to the patient and more work for the nurse.

The apparatus used in the Carrel-Dakin treatment is complicated and expensive. Rubber tubing is difficult to get and high in price, and a great quantity is needed.

We are told that the main reason that there are fewer infected wounds in the army hospitals now than there were at the beginning of the war is that the primary operation is being performed on an average one and a half hours after the receipt of the injury instead of many hours or may be days. In a hospital using the Carrel-Dakin treatment much time is used in putting the tubes in place and fastening them there. Following a "push", many hours will be used in an operating room doing this work that will keep some less fortunate patient from getting prompt attention.

Because of some of these objections we decided to try out another chlorine antiseptic which was reported in the *Journal of the American Medical Association*, July 7th, 1917, by Dakin, Lee, Sweet, Hendrix, and LeConte, viz.: Toluene-parasulphon-dichloramin, or as Dakin named it, Dichloramine-T. This substance has the chemical formula $CH_3C_6H_4SO_2NCL_2$, and was made first by Kastle, Keiser and Bradey[2] in 1896, and later by Chattaway[3] in 1905, and more recently brought out and used by Dakin.

It is an aromatic chloramine in powder form containing a little over 29 per cent. of chlorine. It is made in the following manner: chlorinated lime (from 350 to 400 gm.) of good quality (of 25 per cent. or more of available chlorine), is shaken with two litres of water in a shaker for half an hour and then allowed to settle. The supernatant fluid is siphoned off and the remainder filtered. Powdered toluene-parasulphonamid, 75 gm., is then added to the whole of the hypochlorite solution and shaken until dissolved. The mixture is filtered, if necessary, placed in a large separating funnel and acidified by the gradual addition of acetic acid (100 c.c.). Chloroform (about 100 c.c.) is then added to extract the dichloramine, and the whole is well shaken. The chloroform layer is tapped off, dried over calcium chlorid, filtered, and allowed to evaporate in the air. The residue is powdered and dried in vacuo.

Another method, more rapid for greater quantities, is as follows: 50 gm. of para-toluene sulphonamid are dissolved in 500 c.c. of water, and 100 gm. of sodium acetate and 100 c.c. of chloroform are added. The container is immersed in cold water, and a rapid stream of chlorine is passed in until the mixture is saturated. The mixture is allowed to stand a few hours, and, if the odour of chlorine

disappears, more of the gas is passed in. If necessary, more chloroform can be added to dissolve the dichloramine. From this point the procedure is the same as in the preceding method.

Its use as a disinfectant is dependent on the reaction of the NCL^2 group in the side chain. In this group the chlorine is very loosely held and is given off whenever the substance comes in contact with any other material having an affinity for chlorine.

This takes place in the presence of proteins. All proteins contain large numbers of amino acid groups represented by the formula $R-\dot{C}(H)-CO-NH$. The H atom attached to the N atom is replaced by the Cl atom $R-\dot{C}(H)-CO-NCl$. This compound then contains the NCl group and belongs to the class of chloramines. Their chlorine is still active and they are themselves active germicides. Other reactions also occur which use up part of the chlorine, converting it into an inert form, *e.g.*, the chlorine becomes united to carbon or forms chlorides. This is the chemical reaction that takes place between the dichloramine-T and the proteins of the bacteria, and this chlorination of bacterial protein seems to be incompatible with the life of the micro-organism.

We know from our study of chemistry that the union of chlorine with other substances is greatly hastened by the presence of water, even the small amount of moisture in the air, by the action of light, especially direct sunlight, and by heat. Keeping in mind these characteristics of chlorine and chlorine compounds we will consider the characteristics of dichloramine-T.

It is only slightly soluble in water, but freely soluble in certain oils and in benzol, chloroform, carbon tetrachloride, alcohol, and acetone. In order that the dichloramine-T may be used efficiently it must be in solution. Of the different solvents, chloroform and carbon tetrachloride are the only two that contain their limit of chlorine and therefore give us permanent solutions, but as these cannot be used continuously on the tissues they cannot be used as carriers for the dichloramine-T. Eucalyptol is one of the oils that will dissolve it, but this oil, having an affinity for chlorine, extracts

the chlorine from the dichloramine-T, causing decomposition. But if chlorine is added to the eucalyptol before dissolving the dichloramine-T in it, we get a fairly stable solution. Originally[4] the eucalyptol was treated with potassium chlorate and concentrated HCl, the result being an oil containing about 1 per cent. of chlorine.

This oil would dissolve about 15 per cent. of dichloramine-T, but because it caused irritation when used on wounds it was found necessary to dilute it up to 50 per cent. with paraffin oil, also chlorinated. These are the preparations that have been on the market for some months.

We, however, had considerable difficulty in getting stable solutions with these mixtures. The addition of the paraffin caused a precipitate to form in two to four days.

In October last, while in Philadelphia, Dr. Paul Lewis, of the Henry Phipps' Institute, told me of another method that they were using to chlorinate the eucalyptol, and we soon had some made in the laboratory here. Since then Krauss and Crede[5] have published this method of making it. Chlorine gas from a cylinder is passed through eucalyptol for about 30 hours in good daylight, the temperature being kept below 80°C. by regulating the flow of gas. This raises the specific gravity from 0·925 to 1·200. It was then neutralized with dry sodium carbonate and dried with calcium chloride, when it was ready for use. This oil would dissolve 20 per cent. dichloramine-T and could be used without diluting with chlorinated paraffin. The great advantage of this solvent was that a solution of dichloramine-T in it was stable for at least six weeks if kept under proper conditions. Also, a great mass of antiseptic, say 20 per cent. dichloramine-T, could be used for a primary application in the operating room.

This is the solvent that we have used in most of our cases up to February 15th. As it did not come on the market, we made it in the laboratory, and after some trouble succeeded in turning out a good product.

In January, 1918, Dakin and Dunham[6] suggested the use of chlorinated paraffin wax, to which they gave the name *chlorcosane*, as a solvent for dichloramine-T. This is made from ordinary paraffin wax chlorinated by passing a rapid stream of chlorine through it until it has increased about 50 per cent. in weight. The temperature must be kept between 125°C. and 140°C. The hydrochloric acid formed is then neutralized with dry sodium carbonate and the oil filtered while hot. We promptly set up the apparatus and made the solvent, and the results are even better than

we anticipated. We obtained a solvent that was much cheaper, materials costing about forty cents instead of four dollars, and the time to make it reduced by several hundred per cent. This solution causes no irritation whatever on the most painful wounds. Another great advantage is that the odour is very much reduced and much less disagreeable. It is a clear oil, slightly heavier than water, with a high viscosity. It will dissolve at room temperature 8·5 per cent. to 10 per cent. of dichloramine-T. To make the solution, it is advisable to heat one fourth of the oil to 80°C., dissolve the dichloramine-T in it and then add the other three fourths of the oil, as the dichloramine-T dissolves much more rapidly in the heated wax.

We use this solvent with 5 per cent. dichloramine-T now in all cases except skin grafts and large superficial wounds such as burns, where we use 1 per cent.

There are several precautions one must take in using dichloramine-T, which all depend on the fact that the solution, if not kept properly, may be easily decomposed.

1. It must be kept in dry brown bottles (blue bottles will not do), and not exposed to sunlight.

2. If water, alcohol, or other adulterant, even a few drops in amount, is introduced into the bottle, it will cause decomposition in the course of twenty-four hours.

3. Decomposition is indicated by the presence of crystals in the solution, or by the appearance of cloudiness. This means that the dichloramine-T has been broken up and toluene-sulphonamide formed. This is not an antiseptic and is an irritant. Therefore, decomposed solutions should be at once discarded. In chloroc-sane solutions, if they are kept cold, the wax may crystallize slightly. Gentle heating will cause this to melt again. Toluene-sulphonamide, the decomposition product, will not dissolve except in hot solution.

4. Bottles or other containers of solutions of dichloramine-T should be cleaned with chloroform as this will dissolve the dichloramine-T and the wax. They should then be thoroughly dried before using. Containers in which the dichloramine-T has decomposed should be washed thoroughly with hot water and dried before using again.

5. Wet dressings should not be put over a wound on which dichloramine-T has been used, because the water will cause decomposition of the dichloramine-T in the wound.

6. If used in an atomizer this should be all glass as the chlorine will corrode metal or hard rubber.

The results we obtained with dichloramine-T were certainly as good as those we had with Dakin's hypochlorite solution. We have a solution now that, unmixed, is permanently stable, or mixed, is stable for from two to three months, and only takes a fraction of the time to make up.

Very little training is necessary to know how to use it, and that only on the part of the surgeon or house surgeon doing the operation and dressings. As the nurses have nothing to do with the dressings, they do not need to be specially trained.

The amount of dressing material used is very much less. On Ward A (Toronto General Hospital) we use about three fourths as much as the other services. On account of the uneven number of dressings done we cannot give exact comparative figures, but Sweet gives figures for a hospital in France. With an equal number of dressings done, the ward using eusol needed three times as much gauze and about 20 per cent. more cotton than the ward using dichloramine-T.

The apparatus necessary for the use of the dichloramine-T is an all-glass atomizer and occasionally a glass pipette or a small rubber catheter, which is considerably less than the Carrel apparatus.

The time necessary for the primary operation is considerably lessened as there are no tubes to put in place and retain there. The time used in doing the dressings is also less, Sweet reporting that he does thirty major dressings in ninety minutes.

Considering the question of the transportation of wounded, it is well known that the Carrel-Dakin treatment cannot be carried out when a patient is being transported, but with dichloramine-T it is quite simple.

We wish now to present in detail the method of using dichloramine-T in different conditions with certain case reports.

We have purposely put the treatment of newly made wounds at the first in order to make it more impressive, because we feel that in this class of wounds, dichloramine-T is of the most service. We are more and more impressed with the importance of the interval of time elapsing between the receipt of the injury and the time of primary treatment as being the most important factor in the prevention of infection.

In the battle of the Champagne 80 per cent. of the cases contained the gas organism in the wound when cultured and 60 per cent. had the clinical symptoms, but in the battle of the Somme but 20 per cent. had gas on culture and only 5 per cent. showed

clinical symptoms. In 1915, our mortality was 4·6 per cent. but in 1916, it was only 1·9 per cent. Why this improvement? Many voluminous reports have appeared of greatly improved results in the treatment of wounds with many germicidal agents.

But the fact that this improvement was not confined to wounds treated with any one particular germicide suggests that at least other factors might be equally important. The organization of the armies had so improved during this year and a half *that the wounded were being treated in one and a half hours instead of from five to seven days*. Furthermore, the surgeons were equipped more completely so that the primary operations were thorough. Removal of 20 per cent. of the foreign bodies and routine free incision with wide excision of dead and devitalized tissue had been practised.

It is no doubt these two points that have brought down the death-rate. Moynihan and Crile claim that all that is necessary is excision of the devitalized tissue. Carrel technique calls for the same operation.

Our technique has been to use gasoline to clean the surrounding skin, to remove as much devitalized tissue as possible, then swab all the wound surfaces with dichloramine-T, leaving them wet with it and, if the wound has been received within six hours, to stitch it up without drainage.

Dichloramine-T does not affect the tensile strength of catgut, nor the holding of the knots, so that the danger of secondary hæmorrhage from the slipping, or premature absorption of ligatures can be disregarded.

At the Midvale Steel Works, near Philadelphia, where there are about 12,000 employees and where there is a well organized hospital that keeps accurate records, the following comparative results are given.

In 1916 they used iodine, and in 1917, dichloramine-T.

Using iodine they had 9·8 per cent. of their wounds show infection.

With dichloramine-T they had 1·5 per cent. of their wounds show infection.

Primary suture of wounds using iodine as antiseptic gave pus development in 11.6 per cent., while using dichloramine-T there was pus development in only 5·4 per cent.

In a series of thirty-two consecutive cases attended by us we had infection following in one case only, or 3·1 per cent.

Compound Fractures.—In the case of compound fractures we take a swab from the wound for culture, before using any dichlora-

mine-T. Then the wound is opened widely and the devitalized tissue cut away, including the edges of the external wound. Dichloramine-T is then inserted into the seat of fracture, all areas of the wound being thoroughly saturated with it. If the fracture is a recent one, that is, within three or four hours, we would close it without drainage. If over this time, we insert a gauze drain saturated with the oil. This is removed in forty-eight hours and more of the oil injected into the wound. When we get a negative culture from the wound for three days in succession we close it, dealing with the fracture by bone-plating or pegging as we see fit.

Case Report. A. K., admitted to Ward A, Toronto General Hospital, November 27th, 1917, about fourteen hours after sustaining comminuted fracture of lower end of humerus with small lacerated wound. This wound gave us a culture of staphylococcus and streptococcus. It was opened widely, swabbed with dichloramine-T, packed with dichloramine-T gauze, and partly stitched. More oil was injected into wound through a medicine dropper daily. Several negative cultures were obtained and about two weeks after admission the wound was opened, the two lower fragments were fastened together with a bone screw, and the upper fragment when reduced was held in place by its spiculated extremity. The wound stayed clean and he was discharged five and a half weeks later.

Secondary Suture Cases. The question of the secondary suture of wounds is a very important one, especially from a military standpoint. One of our earliest cases is an illustration of the efficiency of dichloramine-T.

Case shown to Surgical Section in November, 1917. E. D., admitted to Ward A, Toronto General Hospital, September 18th, 1917. About one month previous he had had his foot crushed and a Syme's amputation was performed. The wound became infected and on admission to the hospital the flap had dropped down, and its anterior surface as well as the end of the stump was covered with thick unhealthy granulation tissue with a few small sloughs still attached. The discharge from the wound was a thick yellow pus with a very foul odour. Culture showed staphylococcus infection. The wound was sprayed with 5 per cent. dichloramine-T. In twenty-four hours the odour had disappeared and the discharge had lessened considerably. On the sixth and seventh days by direct smear we could find no bacteria, and on the ninth day we scraped off the granulation tissue, trimmed the edges of the flap and stitched it into place. There was a slight discharge from a small sinus at

the side of the wound for some time, but when a small sequestrum from the end of the stump was removed, the sinus soon closed. This illustrates a point we have proven by several cases, viz.: that if a wound does not soon become sterile with the use of dichloramine-T, it is either because the antiseptic is not getting to all parts of the wound or there is a foreign body present.

Cellulitis. The focus should be excised when mechanically practical, but if this is impossible it should be widely exposed so that the germicide may have an opportunity for a complete chemical contact with the bacteria. Adequate drainage should be provided according to accepted surgical principles. Then the wound surfaces should be thoroughly covered with dichloramine-T solution and the edges of the wound held apart by gauze packing saturated with the solution. A very light gauze dressing is then applied, not more than four layers of gauze being necessary. If the discharge is excessive, fresh gauze may be reapplied during the day, but in our experience this is not necessary for more than a day or two. One does not need to use thick cotton pads on these wounds. The dressing is done once a day using all aseptic precautions. The gauze packing is removed and not reapplied unless the walls of the wound fall in and make it impossible to insert the antiseptic. Dry cotton wipes only are used to wipe out the wound. The dichloramine-T is sprayed into the wound with an atomizer if it is superficial, or injected into the deeper parts through a soft rubber catheter or a glass pipette. The same minimum amount of dressing material is used. When a culture shows the wound to be sterile it is not necessary to do dressings oftener than once in two or three days.

Case Report No. 1. T. B., referred by Dr. Shields. Admitted to Ward A, February 11th, 1918. Four days previous his left wrist became swollen and sore. Two days later it was swollen to the elbow. On admission the arm from wrist to shoulder was greatly swollen, browny red, and extremely painful. There was a small area of fluctuation over the top of the olecranon. Temperature, 103·4°; pulse, 140. Patient was perspiring profusely and was profoundly toxic. Operation, 9.30 p.m., February 11th. Incision into the fluctuating mass over the olecranon revealed a bursa full of clear serum. Eleven other incisions each about two inches in length were made in the arm. From the incisions above the elbow just a clear serum was obtained, but from those below the elbow a thin watery pus exuded. The infected subcutaneous tissue was broken down with the finger. The wounds were then swabbed with 20 per cent. dichloramine-T, and gauze packing soaked in the same

strength solution was inserted into the subcutaneous space between the incisions. Light dressing applied and patient returned to ward with orders to the nurses to keep several hot water bottles applied to the arm continuously.

Culture of the pus showed presence of pure streptococcus.

On the second day after operation the temperature was normal and remained so. On the seventh day culture from the wound was sterile and on the twentieth day all the wounds were closed except the one over the olecranon.

Case Report No. 2. F. S., admitted to Private Patients' Pavilion, Toronto General Hospital, under Dr. F. N. G. Starr, December 26th, 1917.

Three days previously he cut his right hand on a porcelain tap. On admission the temperature was 101°, pulse 132. The hand was greatly swollen, extremely painful, and the skin over the hypothenar eminence was black, and on removal it was found that the muscle underneath was apparently gangrenous. There was a thin watery discharge from all parts of the palm. The infection was opened by four incisions and was swabbed out with 20 per cent. dichloramine-T. Three tubes were inserted for drainage. Culture showed pure streptococcus.

On the third day his temperature was normal, and in a week a culture from the wound was sterile and in less than three weeks was completely healed.

Carbuncles. Until recently we always felt that we got better results by completely excising a carbuncle. Our method of treatment has changed, however, since using dichloramine-T. We now make a crucial incision, curette out as much of the necrotic tissue as possible, insert a drainage tube through the base of each flap, swab out the wound with 20 per cent. dichloramine-T and leave it packed with gauze soaked in the same solution. The gauze is removed the following day and replaced by fresh gauze soaked with 20 per cent. dichloramine-T. The day following all packing and tubes are removed and the wound thoroughly sprayed with 5 per cent. dichloramine-T. The force of the spray very soon dislodges any particles of necrotic tissue left.

We have treated several cases, but one will illustrate.

Case Report.—T. G., referred by Dr. C. E. Stacey on February 2nd, 1918. Carbuncle three and a half inches in diameter on back of neck. It had several openings and was discharging profusely. It had been incised three days previously but was now spreading rapidly. Crucial incision, sloughs swabbed out with

gauze wipes, drain put in base of each flap after swabbing our with 20 per cent. dichloramine-T. Daily dressings with 5 per cent. dichloramine-T. On the seventh day all slough was gone. On ninth day the incisions were healed with the exception of a small area in the centre that was granulating over. On the twentieth day the wound was healed.

Lee advises secondary suture if the wound becomes sterile before the twelfth day. He reports good results. We have had no satisfactory cases to try it on.

Intra-abdominal Infections. We have used dichloramine-T in several cases of appendicitis that required drainage. Our technique in these cases was to swab the bowel in the neighbourhood of the infection with 20 per cent. dichloramine-T, pack gauze soaked in the solution into all parts of the infected area, insert through and through silk-worm gut sutures, and leave them untied. In cases where the split muscle opening was made the two middle sutures were so inserted that when drawn tightly, they pulled the separate parts of the internal oblique muscle together. The following daily dressings consisted in applying from two to three c.c. of the oil around the wound and gauze, and in about four days the gauze will come out quite easily. Each day after this the sinus is filled with 5 per cent. dichloramine-T. On obtaining a sterile culture from the wound, the sutures are tied. Sometimes it will only be necessary to leave a small opening for the gauze and stitch up the rest of the wound. In this case after the gauze is removed the sinus is filled daily with oil until it fills in with granulations.

Frequently there are appendices removed and the question arises as to whether a tube should be put in for drainage, owing to the gangrenous condition of the organ and the possibility of a small amount of peritoneal infection being present. In these cases, if one will thoroughly swab off the bowel in the neighbourhood of the appendix stump with dichloramine-T, and likewise the incision through the abdominal wall, one will find that the antiseptic is enough to take care of any infection left.

Any other intra-abdominal infection can be treated in a similar manner.

Case Report No. 1.—Mr. S., patient of Dr. F. N. G. Starr.

November 14th, 1917, large appendiceal abscess opened through split muscle incision and appendix removed. Cavity swabbed out with 20 per cent. dichloramine-T and packed with gauze, 20 per cent. Silkworm gut stitches put in, but not tied. In this case the gauze was removed the next day by the houseman. For fourteen

days 5 per cent. dichloramine-T was injected into sinus. On fourteenth day the bacterial count was 1-10. The granulations were swabbed off the surface and the stitches tied. There was only a very slight discharge after this, and the patient walked out one month from the day he came in.

Burns. It appears to us that in the treatment of burns there are three things to accomplish: (1) the relief of pain; (2) the control or elimination of infection; and (3) the promotion of healing. The first point is accomplished if a dressing is used that does not cause pressure or irritation to the wound; the second is obtained if an efficient germicide is used—for all burns are infected; the third results from the use of a dressing that does not need to be changed frequently, thereby causing the least disturbance to the delicate newly formed epithelial cells, and the use of an antiseptic that does not injure the newly formed cells nor cause the formation of unhealthy granulation tissue.

As a dressing for burns we use an open mesh paraffined mosquito netting as suggested by Captain W. P. Furness[8] of Philadelphia. It is made by dipping sterilized mosquito netting into melted paracol, or other wax with low melting point, and allowing to drain. This results in a thoroughly waxed, open meshed gauze. This is placed in close contact with the surface of the burn and fastened around the edges with hot wax or adhesive. No other dressing is put over this but it is left exposed to the air. The wound is sprayed with 1 or 2 per cent. dichloramine-T daily. As the discharge forms it comes out through the open meshed gauze and can be picked off at each dressing with a pair of forceps without removing the gauze. This is a painless procedure and does not interfere with the delicate newly formed tissue. As the dichloramine-T is not an aqueous but an oily solution, it does not tend to make the granulation tissue œdematous, but rather we note that it is of a very bright red healthy colour and does not heap up. We feel that this dressing deals with the three essentials in the treatment of burns as efficiently, if not more so, than any other.

Case Report.—J. W., February 21st, 1918. Patient fell with forearm against the stove, causing burn of third degree, and tipped hot gravy over arm causing scald about eight by five inches. When seen next day the blisters were broken and considerable discharge was present. Wound cleaned with dry wipes and dressing forceps. Edges of wound cleaned with gasoline. Paraffined gauze fastened on with adhesive. Sprayed with 5 per cent. dichloramine-T in chlorcosane. Dressed daily. Crusty discharge removed with for-

ceps from surface of netting and sprayed with 1 per cent. dichloramine-T. The dressings were painless and easy. On the tenth day the scald wound was healed and on the nineteenth day the burn wound was healed.

Skingrafts. It has heretofore been considered impractical to skingraft wounds that were not sterile, partly because the grafts would not take, and partly because antiseptic dressings could not be used for fear of destroying the grafts. We have found that it is not necessary, although it is to be preferred, to have the wound absolutely sterile. We get the wound as sterile as possible, lay our grafts and cover them with the paraffined netting spoken of above. This is left exposed to the air. Each day the discharge that forms is removed from the outside of the netting and the whole wound is sprayed with 1 per cent. dichloramine-T. About the tenth or eleventh day the netting is removed without any difficulty whatever. It shows no tendency to adhere to the wound or the grafts.

We have had several good cases but two of them will illustrate.

Case Report No. 1.—G. H. A., admitted to Toronto General Hospital under Dr. F. N. G. Starr, on January 21st, 1918. Seven weeks previously scalded left leg to knee. Wound became infected, and among others, the following dressings were used: moist boracic, bichloride, 1-100 carbolic, boracic ointment, amberine, normal saline, and Dakin's solution. None of these were efficient and when admitted to the hospital the most of the surface of the leg was devoid of skin and discharging a foul purulent matter. It was cleaned and swabbed with 20 per cent. dichloramine-T, and he suffered for some hours. The next day he told us the leg had not looked as well in seven weeks. We used 5 per cent. dichloramine-T daily, and as soon as the infection became controlled the skin grew in very rapidly. On the seventh and ninth days culture from wound was sterile, and on the tenth day it was skin-grafted. Daily dressings were done, each time removing the discharge that had come through the netting, without disturbing the grafts. At first we had normal saline sprayed on the wound every hour. We have since come to the conclusion that that is unnecessary. Daily applications of 1 per cent. dichloramine-T with atomizer is all the dressing necessary to keep the grafts soft. On the eighteenth day the netting was removed and the graft had practically all taken. This man walked our of the hospital about six weeks after operation.

Case Report No. 2.—W. B., admitted to Ward A, Toronto General Hospital, January 21st, 1918. Hand was crushed between

steel rollers, the skin being pulled off and several of the phalanges fractured. The tips of the fingers were all amputated and the hand dressed with dichloramine-T. Pyocaneus infection followed. This was very difficult to clean up, but when the wound was granulated over and all sloughs removed, even when pyocaneus was still present, we skin-grafted. This was covered with the netting and dichloramine-T applied daily. The graft took perfectly and in four weeks all dressing was removed from the hand.

We have no experience with the use of dichloramine-T in *brain work*, but Harvey Cushing[7] reports as follows:

At a casualty clearing station in France in three months they had one hundred and thirty-three cases of wounds with dural penetration. Among the first forty-four cases they had twenty-four deaths, or 54·5 per cent. Among the second forty-four cases they had eighteen deaths, or 40·9 per cent. Among the third forty-five cases they had thirteen deaths, or 28·8 per cent.

He attributes the lowering of the death-rate to four prinicpal changes in their technique, viz.: (1) the removal *en masse* of the fractured area of the cranium; (2) the probing of the wound in the the brain for foreign particles with a soft rubber catheter instead of the finger; (3) the removal of the disorganized brain tissue by gentle suction through a catheter; and (4) the routine use of dichloramine-T. In speaking of the last point he says:

"The use of watery solutions of antiseptics in the brain is disappointing for they lead to œdema and swelling of the tissue and an increased tendency to herniate. It was not until Dakin's dichloramine-T came to be utilized as a routine during the latter weeks of our service that there was a notable diminution in the number of infections.

"It is true that the technique of the procedure had greatly improved at this time and true also that we can record no thoroughly conclusive bacteriological studies, though cultures of many of the wounds and foreign bodies were made. With dichloramine-T in not a few cases in which an infected foreign body was removed and in which bone fragments as well gave an abundant growth, no symptoms whatever followed closure of the wound without drainage. In two instances the cultures showed the presence of the pneumococcus in the ventricular fluid, and the only patients in the series who have recovered from active gas infection of the brain were treated with dichloramine-T."

He used a soft catheter to inject a few c.c. of dichloramine-T

to the bottom of the cavity, and then moistened the surfaces of the external wound with it before sewing up.

Tubercular Wounds.—Our experience with the use of dichloramine-T in tubercular wounds has been limited owing to the unsatisfactory results obtained in a couple of cases some months ago. Following this, we treated some active tubercle bacilli with dichloramine-T for varying lengths of time by putting an emulsion of the bacteria on some dichloramine-T in a test tube. The chlorine from the dichloramine-T gradually infiltrated the emulsion. In three, five, fifteen, thirty and sixty minutes, and again in twenty-four hours we removed part of the emulsion and injected it into guinea pigs. Up to and including the thirty minute case the bacilli grew, but from one hour and longer the guinea pigs were negative.

When we remember that it takes 5 per cent. carbolic acid with equal quantities of sputum, intimately mixed, about twenty-four hours to kill the tubercle bacillus, and that $2\frac{1}{2}$ per cent. carbolic will not even kill then[9], we cannot help but feel that dichloramine-T is also efficient for tubercular wounds. Further experiments are being carried out now.

Empyema of the Pleural Cavity.—Our experience with dichloramine-T as a sterilizer for empyema cavities has not been altogether encouraging. Two acute cases following pneumonia had a short convalescence, which was very satisfactory. Three old cases in which the cavity had been draining from three to twelve years were treated by Estlander operations, and shortly afterward dichloramine-T was injected into the remaining cavities. The oldest case closed in a few weeks; in the second case the cavity diminished to one fourth the former size in two months. We are hoping it will close completely. The cavity in the third case is practically the same size as it was when we started the treatment. This patient had syphilis until recently, which may account for this poor result.

One gratifying point about the use of dichloramine-T in these cases is that the patients all feel better and apparently there is much less toxin absorbed as long as the oil is being used.

Our technique has been to insert a soft rubber catheter into the cavity and inject through it from 5 c.c. to 20 c.c. of the oil. Then we have the patient move slowly into different positions in order to get the oil to flow to all parts of the wound. This dressing is done once a day.

From several of our cases we have obtained a negative culture after several days' treatment, but if we discontinue injections for a few days, the bacteria again appear.

It may be that if, at the time of the Estlander operation, a strong solution of the antiseptic was used before sewing up the skin wound, or if the cavity were packed with gauze soaked in the oil, the results might be a little more satisfactory.

Mastoiditis.—From reports received from several of the ear, nose and throat men who are using dichloramine-T in mastoid infections, I gather that it is also effective in these conditions. Dr. Charles Clark tells me of three bad mastoid cases that closed completely in eleven, twelve, and fourteen days respectively. He notes particularly the early disappearance of pus, the healthy appearance of the granulations, and the rapid closing of the wound.

Urethritis.—I have just used dichloramine-T on one case of gonorrhœal infection. In this case I sealed the oil in the urethra and left it there for nine hours. The patient complained the next day of pain on micturition, but I have been unable to find any trace of gonococci in the smears since. I would advise, instead of sealing in the oil, that it be held for ten or fifteen minutes only. It must be noted here that only solutions in chlorcosane should be used. Solutions in eucalyptol would cause irritation.

Drs. Jones and Hair are going to use it in the Genitary Urinary Clinic at the Toronto General.

Diphtheria Carriers. When Dakin first suggested the use of dichloramine-T as an antiseptic he used it to disinfect the nose and throat of diphtheria and meningitis carriers. When the technique is properly carried out, this makes a very efficient treatment. Saline should be used first, to clean out the nares and throat, and then the dichloramine-T in 5 per cent. solution sprayed on with an atomizer every three hours. Spraying should be discontinued for twenty-four hours previous to taking a culture, and if it proves negative, the spraying is discontinued again for twenty-four hours. In the case of getting two negative cultures, the patieut may be considered no longer a carrier. We had a very good opportunity recently to test this out. Dr. W. C. Allison of the Provincial Board of Health spent some weeks in a western town cleaning up an outbreak of diphtheria. They used dichloramine-T on fifty-nine cases. These cases had been in quarantine on an average of fourteen days and they were released after using dichloramine-T on an average for five days. Nurses gave all the treatments, which were carried out, not every three hours, but only three times a day. Those who have

worried over these cases for weeks and may be months, will realize how quickly these cases were cleaned up.

Colonel Primrose, who has seen at first hand the results obtained by the originators of several of the modern methods of treating infected wounds, warns us that we must keep an open mind regarding this question. They all claim good results, and he has seen that they are getting them. All others do not get these good results, no doubt, because they do not know or do not adhere to the proper technique. We *know* that dichloramine-T will sterilize infected wounds if it gets into all parts of the wound and there are no foreign bodies present, and we feel that, as the technique is so simple and the results just as good, we have in dichloramine-T an antiseptic that is, at least, among the best.

I would like to thank Captain Roscoe R. Graham for inducing me to take up this study, Dr. F. N. G. Starr for furnishing most of the clinical material and much encouragement, Captain Walter Campbell for his help with the chemistry and laboratory work, and Dr. Laughlen for his assistance with the bacteriological work. Without the help of these my work would have been without results.

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CEREBRO-SPINAL SYPHILIS

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SINCE the discovery of the spirochæta pallida in the brain of patients who had died from dementia paralytica, and also in the cords of those who had died from tabes dorsalis, the classification of syphilitic diseases of the central nervous system has been greatly altered. We no longer speak of the parasyphilitic diseases of the nervous system but according to whether we adopt the classification of Head and Fearnsides or the more American classification we speak of, syphilis meningo-vascularis or syphilis centralis, or, the interstitial form of cerebro-spinal syphilis, and the parenchymatous form. Naturally we may have and often do have a mixed form. Under the first class we place all the acute or sub-acute cases of involvement of the central nervous system and under the second class we have the chronic cases of tabes and general paresis or the mixed type of tabo-paresis.

We have analyzed from the records of the Royal Victoria Hospital during the last twenty years seventy-four cases of the interstitial type and also have taken six cases of tabes seen in the last year and reported them mainly to show the effect of treatment than from a clinical standpoint. In the seventy-four cases are included three cases of hereditary syphilis but no cases of general paresis.

An analysis of the seventy-one cases reveals some interesting facts. First as regards the history of infection. Fifty-three of the seventy-one cases or 75 per cent. admitted being infected one or more times; eighteen or 25 per cent. denied all knowledge of infection; fifteen of the fifty-three cases or 20 per cent., which admitted infection, gave a history of secondary manifestations of syphilis. This fact is interesting because Ellis, Swift, Mott and others have called attention to the fact that a history of secondaries is rare in patients suffering from tabes dor alis. In a series given by Ellis and Swift sixteen of the thirty patients, or 50 per cent., denied all knowledge of secondary manifestation. They, however,

agree with our figures which show that a history of secondaries is more common in patients suffering from cerebro-spinal syphilis, as only five of their patients denied secondaries. The question of obtaining a history of infection from a patient is sometimes difficult, but in our opinion, it is not so difficult as it is generally considered, if the patient is approached in the right manner. Very few men, if asked quietly and in private, will refuse the knowledge of having been infected, if they have been, at some time in their past life, but if asked abruptly before a class of students or in a public ward, will resent the publicity of the questioning and therefore refuse all knowledge. When dealing with women the question, of course, assumes a different aspect, and one is not justified in putting direct questions to a patient, but must rely on the personal and married history.

We have subdivided the seventy-four cases of the interstitial type of cerebro-spinal syphilis into eight divisions according to what part of the central nervous system the symptoms seemed to indicate was most involved: 1 Vascular. 2. Spinal. 3. Meningeal cerebral. 4 Gumma. 5. Basal meningitis. 6. Parenchymatous. 7. Peripheral nerve. 8. Hereditary.

Vascular Type. There were twenty-two cases of this type, and it was the second most common type of all the cases. Thirteen of them were straight vascular involvement. In these cases the most prominent symptom is motor, usually a hemiplegia, which is preceded by headaches for a varying length of time. Case No. 20491 is an example of this type.

E. F. L., age twenty-seven, admitted November 24th, 1913. Complaints—Unable to speak. History—Soft chancre four years ago. No secondaries. Married three years; wife had had two miscarriages. Six weeks ago severe left frontal headache began. Shortly afterwards paralysis of the right face, arm and leg with deviation of the tongue to one side appeared. Report from the out-door department October 30th, 1913, was: paresis of the right facial nerve, tongue protrudes to the right, speech is slow, paresis of the right arm. On November 23rd suddenly lost the power of speech and was unable to swallow. Headache stopped yesterday.

Physical findings. Paresis of the seventh, ninth and eleventh cranial nerves on the right side. Cannot open mouth. Cannot swallow. Both hands are weak. Right fore-arm moves involuntarily. Marked inco-ordination of the arms and one of the legs. Paresis of the vocal cords. Ankle and knee jerks are increased on both sides. Retention of urine. Spinal fluid Wassermann was

negative, Noguchi test positive, six cells, blood Wassermann positive. He was given neo-salvarsan on December 16th and showed gradual improvement. In five weeks he wa speaking, but had only poor use of his legs. December 27th he went to Pawtucket, R.I.; while there he had inunctions daily and massive doses of iodides.

Two of the ca es had symptoms pointing to involvement of the meninges sufficient to produce definite signs of meningeal irritation, because in nearly all cases of cerebro-spinal syphilis the meninges do not escape.

P. R., admitted September 15th, 1900. Complaints—Paralysis of the left arm and leg, with contractures. Spasms of the right side of the body. History—Married seven years. Five miscarriages. Hair fell out after one miscarriage. Husband had some blood disease. Two and a half years ago had violent headaches, worse in the morning, and insomnia. Vomiting and gradual onset of paralysis with spasm first in the face and then in the arm and leg which occurred seven or eight times a day. In a month there was complete paralysis of the left side. In two months the face recovered, the leg only slightly, and the arm not at all. Two years ago contracture of the left side of the body began. She was treated for one month in the Montreal General Hospital with some improvement of the leg and arm. Later she developed incontinence of urine and fæces.

Physical findings. Spastic flexed arm, left leg spastic to a less degree, ace not affected. Tremor and inco-ordination of the left side. Tactile sensation somewhat impaired on the right side. Some hyper-æsthesia on the right side of the face and right shoulder. She was given potassium iodide in the ward. Improved slightly. Discharged December 12th.

Spinal Type. Nine cases were of the spinal type where the symptoms pointed mainly to an involvement of the cord and under this heading we classed those cases where there was mainly meningeal involvement, meningo-myelitis and radiculitis. Three of them were diagnosed as meningo-myelitis in whom the symptoms were spastic paralysis of the legs or arms depending on the site of the lesion, more or less sensory involvement, increased reflexes and loss of sphincter control.

Case No. 18733 is an example. D., age twenty-eight, admitted September 12th, 1912. History—One year ago contracted syphilis, since then he has been under treatment. Two months ago headache started. Eight days ago had tingling in the legs. Five days ago right leg became paralyzed and had retention of urine.

Physical findings. Paralysis of the right side below the eighth dorsal segment. Paralysis of the left leg below the knee. Paresis of the left thigh. Hyper-æsthesia below the eighth dorsal spine. Anæsthesia below the eighth dorsal spine on the left side; no loss of sensation on the right side. Knee jerks active right and left, right ankle clonus, extensor plantar response on both sides. September 15th was given ·6 salvarsan intravenously. September 30th, incontinence developed, both legs became paralyzed, anæsthesia developed on the right side. In October had many bowel hæmorrhages and died October 16th.

Autopsy. Ulcerative syphilitic colitis and syphilitic myelitis.

One of the cases was diagnosed before admission to the hospital as a case of subacute combined sclerosis on account of apparently clear history of no infection, the age of the patient and the unmistakable sign of involvement of the posterior and lateral tracts.

Case No. 24350. A. T., age forty-six, admitted July 24th, 1916. Complaints—Unsteady gait. History—Seven months ago noticed his gait was unsteady and it has gradually become worse. Two months ago incontinence, with pains and needle sensations in the legs. Examination showed spastic legs with inco-ordination, knee jerks very brisk right and left, double extensor plantar response, considerable Rombergism, loss of joint sense in the hands and toes, unsteady spastic gait. Spinal fluid showed twenty-four cells, positive Noguchi, Wassermann was triple plus and Lange's gold test was positive with a leutic reduction. He was given one injection of salvarsanized serum intra-spinally, and then was discharged at his own request, unimproved.

Two of the nine cases of the spinal type had symptoms pointing to a definite involvement of the posterior roots, such as shooting pains in different parts of the body.

Case No. 24480. M. R., age thirty-nine, admitted August 29th, 1916. Complaints—Headache, pains in the shoulders, abdomen, knees and right breast, vomiting. History—Sores in vulvæ, December, 1915. She was given a salvarsan injection. For four weeks has had the above complaint. Examination showed eight cells in the spinal fluid with negative globulin, triple plus Wassermann and negative gold test. She was given one fiftieth of a grain mercury bichloride in normal saline intra-spinally, which produced an increase of the symptoms.

Meningeal—Cerebral. Thirteen cases out of the seventy-four were classed under this type. The symptoms were mainly headache, epileptiform fits, and stiff neck. Four of these cases pointed to involvement of the convexity.

Case No. 22122. P. C., age twenty-seven, admitted February 11th, 1915. Complaints—Unconsciousness. History—In the last four months he has had fits in which he falls to the ground and bites his tongue. Two days before admission he fell unsconcious and has been unconscious since. Restless and irritable and knows no one. Examination showed fundi negative, spastic arms and legs, incontinence, pin-point pupils. Blood Wassermann was positive. Spinal fluid was cloudy, globulin very positive and seventy-three cells. He was given salvarsanized serum intra-spinally and discharged, speaking and feeling much better.

Six cases were of the general meningeal type where the main symptoms were headache, general weakness and subjective sensory disturbances.

Case No. 21110. J. A., age twenty-nine, admitted May 7th, 1914. Complaints—Weakness. Numbness of the arms and legs. Headache. History—Syphilis three years ago. Secondaries six months later. Persistent treatment, including seven injections of salvarsan, the last one two months ago. One year ago general weakness began. Girdle sensation and deadness of the arms and legs. Six months ago headaches began, not definitely localized, worse in the day. Four months ago hands became shaky. Examination showed tremor of the tongue. Deep reflexes all increased. Right extensor plantar response. Spinal fluid showed increased globulin in twenty-four cells. Hermann Perutz test was positive on the blood and spinal fluid. He was given salvarsanized serum intra-spinally. Re-admitted June 14th 1914, with his general condition much improved; has worked for the first time in nine months. Spinal fluid was under pressure with increased globulin and three cells. He was given salvarsanized serum intra-spinally.

Gumma. There were only two cases in the series that we could diagnose as being of a gummatous nature. One had symptoms and signs of involvement of the left calcarine fissure.

Case No. 23404. E. C., age forty-two, admitted November 30th, 1913. Complaints—Defective vision and headache. History—Five years had temporal headaches. These have not been so severe the last two years. Three years ago became suddenly blind in the left eye. Sight returned, but there has been a steady increasing failure of vision until four weeks ago, when he began to improve again. Denies infection. Examination was negative except for a marked concentric contraction of the visual field of both eyes, with left sided hemianopsia. Blood Wassermann was positive. Spinal fluid was under pressure with increased globulin,

six cells and triple plus Wassermann. He was given salvarsan intravenously, and discharged improved.

Basal Meningitis. This, our largest class, was composed of twenty-three cases. Ten cases had symptoms of involvement of the base only. These symptoms were very severe headaches, optic neuritis, vomiting, paralysis of one or more cranial nerves and spastic paralysis of the arms and legs.

Case No. 10265. D. M., age thirty-eight, admitted October 12th, 1905. Complaints—Headache, weakness, incontinence of urine. History—In 1900, had chancre. One year ago headaches began and also had pains in the legs. September, 1904, had frequency of urination with urgency. Six months ago dizziness and diplopia. Six weeks ago weakness of the left leg. Three weeks ago vomiting began and has persisted. Examination showed paresis of the left arm and leg, some weakness in the right arm. Reflexes increased especially on the right. Left extensor plantar response. Rombergism positive. Paresis of the right internal rectus muscle. Patient had excessive vomiting with nausea and dizziness so that rectal feedings were necessary. The left sided weakness increased until the arm was almost paralysed. Nystagmus developed in both eyes. The right vocal chords were paralyzed and there was paresis of the right half of the palate. She was given mercurial inunctions and potassium iodide and was discharged January 27th. The vomiting had ceased but her condition was otherwise much the same.

One of the cases showed involvement of the two upper branches of the fifth nerve.

Case No. 7091. Mrs L. S., age thirty, admitted July 10th, 1902. Complaints—Headache, vomiting, paralysis of the face and left arm, sore left eye. History—Six abortions, since then five living children. Four years ago had sore throat and nose, and hair fell out. Three years ago, discharge in the left ear with resulting deafness. Two years ago sudden facial paralysis—the left eye was open and the face was drawn to the right. One year ago headaches, temporal in character worse in the morning before arising. Six months ago pain in the left eye developed. Four weeks ago unconscious for fifteen minutes. Three days later another unconscious attack, during which there were clonic movements of the whole body. Since then she has had seven convulsions with loss of consciousness and other attacks of tingling and jerking of the arms without loss of consciousness. Three weeks ago vomiting began.

Examination showed diminished sensation over the left two upper branches of the fifth cranial nerve, involving the conjunctiva, nose, mouth and tongue to the mid-line. A left-sided facial paralysis. Diminished taste and smell on the left side. Deafness on the left side with a discharge. The pupils were active. Tongue was protruded straight. Anterior staphyloma. Knee jerks were increased. On August 15th, patient burnt the left side of her face while washing with hot water. Had three fits while in the ward. She was treated with mercurial inunctions and potassium iodide. Discharged August 17th, improved.

Only one case of the series showed involvement of the cerebellum.

Case No. 15990. L. S. L., age twenty-one, admitted September 17th, 1910, complaining of vomiting and dizziness. History—Eighteen months ago possible infection. Five months ago paralysis of the right leg and paresis of the right arm. Three weeks ago began to have dizziness and vomiting. Examination showed left nystagmus. Diplopia on looking to the right. Weakness and incoordination in the right arm and leg. Reflexes normal, no Babinski. He was given inunctions and potassium iodide for three weeks. He left the hospital November 3rd without any symptoms. Diagnosis—cerebellar syphilis.

He returned April 24th, 1911, with a history of having weakness in the legs for two months and in the left arm and leg for one week. He was given ·5 grammes salvarsan intravenously. Discharged improved. Re-admitted December 15th, 1915. On April 15th he had had vomiting and dizziness for eight days and since then the dizziness has persisted, and he had had two vomiting spells. In July his gait became uncertain. In December began to have weakness in the arm and leg with headaches and ataxia of the right arm. Examination showed paresis of the right side, double Babinski and ankle clonus. Asterognosis in both hands. Romberg positive. Anæsthesia of the right upper chest. Diplopia and central nystagmus. Fundi negative. Blood Wassermann negative. Spinal fluid Wassermann negative, five cells and no globulin. He was given a course of mercurial inunctions and iodides for one month. Discharged improved.

Peripheral Nerve. There were two cases in the series of peripheral nerve involvement. The first case showed involvement of the seventh and eight nerves.

Case No. 24836. A. T., age thirty-five, admitted November, 1916. Complaints—Headache, dizziness, deafness, unsteady gait,

with paralysis of the face. History—Fifteen years ago had a discharge from the right ear for three months. July 15th, 1916, had a chronic ulcer on the left side of the neck. August 29th, 1916, had salvarsan intravenously in the Out-door, when blood Wassermann was positive. After a second salvarsan, the ulcer completely healed. Five weeks ago he had dizziness ataxic, gait, nausea, and has had vomiting for three weeks with progressive facial paralysis, headache, deafness and tinnitus. Barany's test showed both vestibular and cochlear involvement in the left ear. There was no caloric reaction. He showed no mystagmus, dizziness or pointing error after syringing for four minutes with ice water. Complete right facial paralysis of the peripheral type. All the tests on the spinal fluid were negative. He was given one intra-spinal salvarsanized serum and twenty days after admission the facial paralysis had almost entirely disappeared, caloric reaction was present, hearing was much improved, headache and dizziness were gone.

Second admission, December 2nd, 1916. Very little paresis of the facial nerve. Hearing normal. Vestibular symptoms disappeared. March, 1917, no symptoms.

The second case showed only involvement of the third nerve.

A. R., age twenty-four, admitted September 15th, 1915. Complaints—Dimness of vision. History of syphilis three years ago. Was treated with six salvarsans and mercury intra-muscularly. Examination revealed paresis of the ciliary muscle. He was given four intra-spinal injections of salvarsanized serum when the spinal fluid was negative and all symptoms had disappeared.

Hereditary. Three cases in the series were diagnosed as hereditary. The most interesting one was

S. C., age nine, admitted March 1st, 1917. Complaints—Headache, difficulty in walking. Mental deterioration. History—Child was perfectly well until three years ago. In the summer of 1914 she had a temperature of 103° with headache and earache for one week. Two months later had a similar attack for four days. Since then she has had nightly headache. For two years had had difficulty in walking. Six months ago had difficulty in speaking, and her mother thought she was tongue-tied. For three years the mother says she has changed mentally, and has grown apathetic, irritable, and perverse. Examination showed normal pupils, slight squint and marked left choroido-retinitis. Spasticity of the legs and slight dysarthria. Reflexes in the legs and feet. She was given several injections of salvarsan and serum under

which treatment the eye condition improved and headache disappeared, but the spasticity of the legs showed no improvement.

A study of the symptoms in the series of seventy-four cases was very interesting. The variability of the symptoms of cerebrospinal syphilis is well recognized, and there is no disease in which one cannot depend upon any definite symptom to make a diagnosis. The most frequent complaint was headache occurring in forty-nine cases and it was the initial symptom in thirty-two of these cases. The headaches appears from a few days to five years before other symptoms but most often three or four months earlier. It is usually a generalized headache, but often is localized to the occipital region. According to text-books, the syphilitic headache is worse at night, but we have been impressed by the frequency in which it has been worse in the morning, shortly after the patient wakes up and it passes off by noon.

The next most frequent symptom was paralysis or paresis, occurring in thirty-four cases. If we sub-divide this symptom, we find that a transient paralysis occurred in seven cases and was the initial symptom in four cases; it was most frequent in the vascular type, five times in ten cases, the left arm being affected twice, the right arm three times, the right and left leg three times. Transient paresis occurred in eleven cases, being the initial symptom in two cases, and in our experience is an early local sign. It is also most frequent in the vascular type, occurring five times in sixteen cases, the right arm and leg each being affected three times, the left arm seven times and the left leg nine times. Progressive paralysis was seen in sixteen cases and was most frequent in the spinal type, four times in sixteen cases; the right and left arm each being affected five times, the right leg seven times and the left leg ten times.

The next most frequent symptom was involvement of the sphincters, which occurred in twenty-six cases. Incontinence of urine was present in twelve cases and is usually a late symptom; it was an early symptom in two cases of meningitis of the convexity. Retention of urine occurred in five cases and it also occurs late. Frequency and urgency of micturition was present in three cases. Incontinence of fæces occurred in six cases, and although constipation was a frequent complaint, we do not consider it an important symptom, because in many of this class of patients regularity of bowel movement is not considered in their ritual of life.

Optic neuritis was seen eleven times in sixteen cases of basal involvement. Diplopia was a complaint in seventeen cases, and eleven of these were of the basal type. The facial nerve was in-

volved in seventeen cases. Dizziness was a symptom in fifteen cases, and in nine of these was the initial symptom. Attacks of unconsciousness occurred in twelve cases being the initial sign on six cases. Vomiting was complained of in thirteen cases, being the initial symptom in three cases and most frequently in basal meningitis, twelve out of thirteen cases. Insomnia is often spoken of as an early sign of cerebro-spinal syphilis; in our series it occurred eleven times and was the initial symptom in three cases.

Other symptoms which were quite frequent were: dysarthria, eleven times; general mental deterioration, eleven times; acute mental symptoms, eleven times; ataxia, ten times; and convulsions, nine times. Altogether there were forty-seven different kind of symptoms.

Head and Fearnsides give a list of symptoms which may serve as danger signals in cerebro-spinal syphilis. They are:

1. Changes in personality and aptitude.
2. Disturbance of sleep.
3. Headache.
4. Shivering attacks.
5. Root lesions.
6. Abnormal reactions of pupils.
7. Disturbance of micturition.

A study of our table will show that our symptoms agree fairly well with this classification, except that we have not had any shivering attacks. Headache, we would say, is the most frequent symptom, occurring forty-nine times and it is the most common initial symptom. Changes in the mentality of a patient and disturbances of sleep are important early symptoms, but after headache, the next most frequent, in our experience, has been loss of motor power, either in the garb of transient paresis or absolute paralysis. Dizziness also is a complaint that must not be overlooked, and in every patient who complains of this annoying condition, syphilitic involvement of the nervous system should be considered.

No symptoms are pathognomonic of cerebro-spinal syphilis, but one must be on his guard when a patient comes complaining of symptoms which are commonly classed under the term neurasthenia.

The age of onset of symptoms in the series of cases was also an interesting study. In seventy-one cases the average age of onset was thirty-four years; the earliest age of onset occurred in the general meningeal type, being thirty years.

AGE OF ONSET OF SYMPTOMS

Type	Average age	20–30	30–40	40–50	50–60
Vascular	32	8	4	2	0
Parenchymatous	37	0	5	1	0
Gen. Meningeal	30	8	2	2	0
Basal	33	14	7	1	1
Spinal	35	3	4	2	0
Total		33	22	8	1

A study of the time elapsing between the time of infection and the onset of symptoms showed that only one month had to elapse before the patient began to have symptoms of infection of the central nervous system and the longest period before the onset of symptoms was thirteen years. In this table we are speaking only, of course, of the interstitial type of cerebro-spinal syphilis, not of the parenchymatous type.

Type	Time elapsing between infection and onset of symptoms	Average time
Vascular	16 months—three years	5 years, 4 months
Parenchymatous	One—twelve years	6 years, 5 months
Gen. meningeal	1 month—eight years	2 years, 3 months
Basal	2 months—eight years	3 years, 2 months
Spinal	5 months—eight years	2 years, 8 months

Diagnosis. We do not intend to dwell long on the question of diagnosis. A careful history, as in all nervous conditions, is most important and a careful study of the list of symptoms present in our series of cases will give an idea of the picture complex this disease assumes. We do want to emphasize, however, the importance of an examination of the cerebro-spinal fluid. In every patient who complains of any of the symptoms we have enumerated and who is suspected of having contracted syphilis at some time of his life, or who admits having been exposed or having had gonorrhœa, a lumbar puncture should be done. It has lately been shown by many observers that a patient may have contracted syphilis under the guise of gonorrhœa, it is not necessary to have a chancre. There is no danger in doing a lumbar puncture provided the patient is kept in bed at least twenty-four hours afterwards. It may be done with the patient either lying down or sitting up, and not more than 10–15 c.c. should be withdrawn. The tests that should be done are Wassermann, colloidal gold, globulin and

cell count. No one of these tests is pathognomonic of cerebro-syphilis, but all of them are of value. The Wassermann test should be done in definitely known dilutions, and, if necessary, using as much as 2 c.c. of the fluid. There is no elimination of bacterial anti-bodies from the blood into the spinal fluid, and only a few chemical substances pass through the choroid plexus, so that a positive Wassermann test means actual involvement of the central nervous system. In the early secondary period, when a slight increase of cells and globulin are found, the Wassermann test is usually negative. Positive reactions in this stage mean a severe infection of the nervous system, a meningitis, with a marked pleocytosis and usually disappears rapidly under vigorous treatment. The Wassermann test is more apt to be positive in involvement of the cord than of the brain. In tabes dorsalis it is usually positive; in general paresis it is positive in both blood and spinal fluid. At this point let us say a word on the blood Wassermann. It is common to hear physicians say that the blood Wassermann was negative, therefore, the patient did not have syphilis. This leads to many disastrous results. Before having a Wassermann test done, the question of previous treatment must always be considered, as it is well known that vigorous anti-syphilitic treatment will cause a negative blood Wassermann. It is quite common to have a negative blood Wassermann and a 100 per cent. positive test on the spinal fluid, so that it is absolutely necessary to do a lumbar puncture before telling the patient that he has not syphilis.

Globulin. An increase of globulin is probably an evidence of vascular disturbances in the central nervous system; it indicates an abnormal transudation from the vessels. All the different tests should be done, Noguchi, Nonne, and Pandy, but in our experience the Pandy test is the most reliable. As Swift and Ellis say: "Its determination is especially important in the early stages of syphilis, since an increase of globulin in the spinal fluid may be the only evidence of invasion of the nervous system in a patient with primary or secondary syphilis, although it is usually accompanied by an increase of cells."

Pleocytosis. This is the estimation of the number of cells in the spinal fluid; over five cells are pathological. The number of cells is highest in secondary syphilitic meningitis, 1000–1500. In endarteritis syphilitica the number is usually normal and in syphilitic spinal paralysis the counts are low, 5–30. In tertiary cerebro-spinal syphilis the count varies between normal and several hundred according to the amount of meningitis.

All laboratory methods should be closely studied with the

clinical findings. In the words of Miller, "The value and interpretation of any laboratory method should always be based upon the most careful clinical study of the cases in which it is applied," and "any normal reaction in the cerebro-spinal fluid may be present or absent in any syphilitic involvement of the brain or spinal cord".

Treatment. The best treatment of cerebro-spinal syphilis is its prevention. This is best carried out by intensive treatment of primary syphilis. The introduction of salvarsan and its allied preparations has probably done considerable harm in the fact that one or more injections of it cleared up all symptoms, so that not only the patient but the physician was led astray. The need of intensive treatment can not be impressed too much upon the patient and the physician must understand that he must not discard mercury, as salvarsan without mercury will not cure syphilis. The recognition of an early involvement of the central nervous system is important, not only on account of the possibility of an early meningitic involvement, but also from the standpoint of prophylaxis of the later or more destructive lesions.

An early form of cerebro-spinal syphilis which is difficult to diagnose, because it gives the symptoms of cerebro-arterial sclerosis, is that type in which the disease involves the vessels in the form of endarteritis. The response of this type to treatment depends upon the extent to which the endarteritis can be favourably affected.

The figures of Mattanschak and Pilcz who studied, from 1880–1900, 4,134 cases of syphilis among the officers of the Austro-Hungarian army in connexion with the treatment of syphilis, are interesting.

Developed paralytica dementia	198—4·8 per cent.
" tabes dorsalis	113—2·7 "
" cerebro-spinal lues	132—3·2 "

	Effect of Treatment		
	No Treatment	One Course	Repeated Energetic
No. of Cases	100	134	924
Developed G. P.	25—25 per cent.	31—23·1 per cent.	30—3·2 per cent.
" tabes	11—11 "	16—11·9 "	25—2·7 "
" C. S. lues	3— 3 "	21—15·6 "	71—7·6 "

	Poorly Treated 1880–84	Better Treated 1895–99
No. of Cases	617	1139
Developed G. P.	60—9·7 per cent.	37—3·2 per cent.
" tabes	22—3·5 "	16—1·4 "
" C. S. lues	15—2·4 "	28—2·4 "

Another point to be emphasized is that in order to be sure that we have cured a case of syphilis, we must examine the cerebro-

spinal fluid, employing all the different tests, and no patient should be pronounced cured of syphilis until the spinal fluid has been negative after repeated punctures.

To-day there are several methods for treating cerebro-spinal syphilis.

1. Salvarsan intravenously alone.
2. Salvarsanized serum intraspinally—Swift-Ellis method.
3. Salvarsanized serum to which is added small quantities of salvarsan intraspinally.
4. Neo-salvarsan in small quantities and weak concentration intraspinally.
5. Mercurialized serum intraspinally.

All these methods have, more or less, been given a thorough trial by different workers, but enough time has not elapsed yet to be able to say whether one or any of them will be absolutely satisfactory. Every physician should, however, not be discouraged by the fact that he cannot give his patient the salvarsanized serum treatment as the intravenous method, in the opinion of many workers, gives as good results as the intraspinal method.

At the Royal Victoria Hospital we have only had experience with the intravenous method, the salvarsanized serum, and two cases of diluted solutions of mercury percloride intraspinally, which produced such severe after results that we did not dare continue it.

According to Swift and Ellis, autosalvarsanized serum contains 0·01 mg. or more of salvarsan per c.c. and a serum is definitely spirocheticidal, and the salvarsan is present in a colloidal combination with the serum, in which form it is probably more slowly diffused out of the spinal fluid, hence is longer in contact with the syphil tic exudates.

During the past year in the Royal Victoria Hospital we have treated thirteen cases of cerebro-spinal lues and six cases of paresis and tabes by the Swift-Ellis intraspinal method. In these cases we have given altogether one hundred and one intravenous treatments followed by eighty-eight intraspinal treatments. Two of these cases were previously treated in our wards, one as far back as six years.

We have withdrawn the blood generally one-half hour after the intravenous injection. In a number of instances we have withdrawn enough blood for two intraspinal treatments, two or three days apart. Our rule has been to give one treatment a week, supplemented by intensive potassium iodide and mercury treatment.

The two following cases are illustrative of the general result we obtained in treating cerebro-spinal lues with the intraspinal salvarsanized serum method.

Case No. 1. A. H., female, age twenty-one, stenographer, admitted January 2nd, 1917, complaining of headache. Her history was that she was exposed in December, 1915. In March, 1916, she had profuse leucorrhœa; in August, 1916, she had a sore in the vagina; in September, 1916, she had dizziness and unsteadiness for three weeks with impairment of hearing; on December 1st, 1916, headaches and sleeplessness began, and on January 1st, headaches became unbearable. Before admittance she had had at least six intravenous injections of salvarsan. Examination showed an extensor plantar response on the left side, with absent knee jerk on that side, no abdominal reflexes and impaired hearing. The Wassermann test on the blood and cerebro-spinal fluid was triple plus; the Lange gold test was 45554321000; the cerebro-spinal fluid was turbid, under pressure there was two hundred and thirty-three cells and a triple plus amount of globulin. Immediately after the first intraspinal treatment her headache improved and has never since been severe. After February 1st, she was up most of the time. After three intraspinal treatments her cerebro-spinal fluid was cloudy, there were fifty-eight cells, slight amount of globulin, the Wassermann test on both the fluid and blood was triple plus, and according to Lange's gold test there was reduction in the pareto-luetic zone. After six intraspinal treatments the spinal fluid was clear, contained four cells, slight amount of globulin and the Wassermann test was negative on both the blood and fluid. In this case, if we had not repeatedly examined the spinal fluid, we would have discharged the patient as cured because all symptoms had disappeared after the first three injections.

Case No. 2. N. K., male, age thirty, admitted August 17th, 1917. Complaints—Headache. History—October, 1915, chancre. Salvarsan nine days later, chancre disappeared. One month later, second salvarsan. Six weeks later the blood Wassermann was negative. Two weeks later sore throat and blood Wassermann was positive. December, 1915, third salvarsan. April, 1916, Wassermann test was negative but had a sore throat. April 20th, 1916, fourth salvarsan. Since then has had four salvarsans as well as mercury and potassium iodide. July 24th, 1916, began to have headaches in the evening and they have persisted ever since. Lately they have been worse in the morning, recurring intermittently during the day. They are mainly frontal around the eyes, but lately have become occipital in character. Hearing has been im-

paired for twelve years, but one week before admission became much worse. Physical findings—Entirely negative.

Course in hospital. After three intraspinal treatments, headache disappeared. September 22nd, eighteen days after admission, he left the hospital, but occipital headache began again almost at once, and he returned for eighteen days more. After one treatment headache disappeared. He had three treatments, and since then has been coming back for a day or two at a time for treatment. Altogether he has had twelve intravenous and ten intraspinal treatments, besides mercury both by the mouth and intramuscularly, and potassium iodide. Only after all this treatment was the spinal fluid clear, no increase in pressure, only a slight amount of globulin, six cells and the Wassermann test on both the fluid and blood was negative.

We have treated six cases of tabes dorsalis and paresis in this way with the following results : one case has been free from pain; one developed severe spasticity of the legs; one developed marked ataxia; one developed incontinence of urine and fæces; one became blind; one vomited for weeks, losing thirty pounds.

In conclusion, our results in tabes dorsalis and paresis have not been very successful, but as we have treated only six cases we do not feel that we would condemn the method altogether.

In acute lesions of the central nervous system the result has been different in all our cases as we have had very satisfactory, and in some cases remarkable, results.

Treatment must be early, intensive, and continued long after symptoms have disappeared, until the spinal fluid has remained negative to all tests for several months. Cases that relapse are those that have received inadequate early treatment.

No hard and fast rule can be established for treatment on account of the variation in individual response and the infinite variability of the extent of infection. One patient may require three treatments, another twenty treatments. Partial treatment is little short of criminal. We must learn to regard syphilis as we regard tuberculosis, a disease that is probably never cured but can be controlled and to which the body can be adapted for a long and useful life.

The question as to whether the intravenous method would not accomplish the same result as the intraspinal method is still unsettled. The very satisfactory results we have had in our acute cases, where often fairly complete intravenous treatment alone had been carried out, will lead us to continue this treatment in this type of case.

Venereal Diseases Prevention Act

SYNOPSIS OF THE VENEREAL DISEASES PREVENTION ACT OF ONTARIO

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THE following is a synopsis of an Act recently passed by the Legislature of the Province of Ontario, with the purpose of controlling venereal diseases.

The Act provides that any person under arrest may, if the medical officer of health believes that the person is infected with venereal disease, be required to undergo an examination in order to ascertain if he is or is not infected with this disease, which by the Act includes gonorrhœa, syphilis and chancroid. If the person so examined is found to be infected, he may be detained and treated. Physicians in medical charge of gaols and other places of detention are required to report within twenty-four hours, any persons confined who may be found to be infected.

If a medical officer of health has credible information that any person is suffering from venereal disease the officer may require such person to be examined, and if the person is infected, the officer may take steps requiring satisfactory treatment.

In order to prevent unjust action against a physician who makes an examination or report in respect to such cases, it is provided that such action can only be brought with the consent of the Provincial Board of Health.

Provision is made for right of entry to a house or premises by the medical officer of health or his deputy in the daytime for the purpose of enquiry or examination in respect to such cases. This provision is identical with the one in force in respect to other communicable diseases.

Hospitals designated by the Board are required to provide facilities for treatment.

No one but a legally qualified physician is allowed to attend upon or prescribe for or supply or offer to supply any drug, medicine, appliance or treatment to or for a person suffering from venereal disease or for the purpose of the alleviation or cure of such disease; the only exception to this being that a qualified chemist may fill the prescription of a physician for such purposes. The penalty for infringement of this provision is $100 to $500. A similar penalty is

provided against advertising in a newspaper, pamphlet or other periodical, any remedy or cure for these diseases. This penalty is also provided for anyone knowingly infecting any person with venereal disease.

Anyone making statements to the effect that a person has one or other of these diseases, except in case of disclosures made in good faith to a medical officer of health or physician in consultation, is liable to a penalty of $200.

Provision is made with the object of maintaining secrecy in respect to cases of this nature by those who have the administration of the Act.

The most important feature of the Bill lies, however, in the powers given the Provincial Board to make regulations in regard to the *forms* and *notices* to be used in the administration of the Act, in regard to the *remedies* to be used, respecting the *course of conduct* of the patient, in respect to the *distribution of information* concerning these diseases, the *regulation of treatment* in hospitals, etc., for *preventing* infection for *reporting of cases* by serial number, of *notices and placards* in public places, *imposing penalties* for infringement of regulations, *procedure in appeals* which may be used as a finality to the Board and the *method and extent of examination* of persons.

The Board is given power to manufacture and distribute remedies free or otherwise to local boards of health, physicians and hospitals.

Any expense in carrying out the provisions of the Act may be incurred by the medical officer of health or local board and such expense must be met by the municipality. The regulations under the Act are now in course of preparation and the law went into effect on July 1st, 1918.

While the effect of this law, which is a fairly drastic one, can scarcely be foreseen, it is reasonable to regard it as a decided step in advance. The restriction of practice in these diseases to qualified physicians and the prohibition of the advertising of quack remedies will, it is hoped, do much to eliminate the baneful effects of treatment by druggists and quacks, who not only do no good, but usually do a lasting injury to the victim of these diseases, not only by leaving them uncured, but, in addition, by giving them a false sense of security which allows of the transmission of disease to innocent parties. Reporting of the names of those infected, which does not seem to have worked well in practice elsewhere, is not sanctioned by the Act, but reporting by number is required.

Editorial

THE NURSING CRISIS

UNDER the heading "The Nursing Crisis", in the June number of *The Model Hospital*, Dr. S. S. Goldwater deals with a subject that is of more vital importance, if possible, to Canadians than to Americans. The American army is looking forward to difficulties in securing a sufficient number of nurses for its own use, and still leave sufficient for civilian needs. The fact that they are anticipating difficulties along this line will probably mean that before long they will meet this difficulty. We, in Canada, have seen this shortage of nurses becoming more acute yearly, and now, after four years of war, are still bemoaning our fate—and this shortage is more acute than ever before.

It is true that in our large General hospitals with their old established training schools, there has been little or no difficulty in keeping up the supply of nurses in training, but the smaller institutions are in very straitened circumstances.

Several plans have been suggested and discussed in Canada and the United States whereby the military needs will be met, and at the same time, the civilian hospital, large and small, be enabled to carry on without lowering the standard of its graduates.

1. An appeal to the young women of the country to enter the ranks of the nursing profession as a patriotic duty. In some localities this has succeeded; in the majority it has failed to meet the demand.

2. That the medical department of the army inaugurate training schools of its own. The effect that this would have on nursing standards after the war should dismiss it at once from our minds. The varieties of clinical material in the

army is too limited. Training schools for nurses cannot be established over night, and we feel sure that this proposal would never meet with the approval of those in a position to judge of the future of the nursing profession in Canada.

3. The Voluntary Aid Detachment. This appears at present the only solution. Let those who propose establishing army training schools for nurses devote their energies to establishing army training schools for voluntary aid workers. The civilian hospitals could be utilized for part of this training. In favour of this proposal one might quote:

(*a*) It is for the duration of the war only.

(*b*) The country would not be flooded with imperfectly trained "nurses" after the war.

(*c*) The class of women best suited for this work have time and money at their disposal. They are of the leisure class, and are not contributing at present to the efficiency of the nation or the success of the war.

4. This latter proposal has the disadvantage of not increasing the number of graduate nurses. Could not some system be worked out whereby the civilian hospitals increase the number of nurses in training, and at some definite period of their training, lend them for so many months to the militia. This would bring under discussion a number of difficulties mostly financial. The housing, board, clothing, text-books, etc., furnished by the hospital to these additional nurses in training would entail an expense that very few if any of our General hospitals could possibly undertake. But if it is the Government's earnest wish to more equally make the supply of nurses meet the demand, and still not detract from the standard of our graduate nurses for the future, this proposal will have many supporters if backed up financially by the Government.

DR. EMMANUEL PERSILLIER LACHAPELLE, President of the Dominion Medical Council, and of the Board of Health of the Province of Quebec, Dean of the

Faculty of Medicine, Laval University, for many years President of the College of Physicians and Surgeons of the Province of Quebec and of the Council of the Notre Dame Hospital in Montreal, Knight of the Legion of Honour (France), died in Rochester, Minn., in the Mayo Hospital, after an operation for symptoms obscurely indicative of a chronic cholecystitis. His health had been failing for some months, and on the advice of friends, he consented to an operation from which he rallied for a few days, but finally his strength succumbed during the late intense heat wave. Through his death, Canada loses one of her most courteous, most able, and most sympathetic personalities in the medical profession.

Born in 1845 at Sault au Recollet, one of the many historical spots in the neighbourhood of Montreal, of parents descended from the very earliest settlers of New France, he received his classical education in the Montreal College conducted by the Gentlemen of St. Sulpice, and his medical training in the School of Medicine and Surgery connected with Victoria University. The subject of hygiene early attracted his special attention, and a few years after graduation, he was appointed Professor of Hygiene in Laval University. His activity in all public matters connected with hygiene became marked, and to him, among others, Montreal owes a debt of gratitude for the active measures which were undertaken for the suppression of its serious epidemic of smallpox in 1885, and for his insistence at that time and ever since on the necessity for universal vaccination. Shortly after this epidemic was subdued a Provincial Board of Health was established and he was appointed its first president. The profession in Montreal has ever since recognized that owing to his firmness and tact many hygienic reforms have been carried out in this province that otherwise would have been impossible.

His professional activities were many. Elected in 1878 as a Governor of the College of Physicians and Surgeons in the Province of Quebec he retained an official connexion with

that body until very recently, for many years holding the office of president. Much of the best legislative work done by the college was enacted at his instigation and under his guidance. He gave much assistance to Sir Thomas Roddick in the framing and the passing of the Federal Medical Act through Parliament, and after its enactment as member of the Council, he took a prominent part in all its deliberations. Failing health prevented his attendance at its last meeting in June, when he would have sat as its elected president. As Dean of Laval Medical Faculty he rendered efficient service, and many generations of students will remember sympathetically the figure of its old Dean, always alert and kind.

His ability and willingness to render service to the community were only limited by his time and strength. He acted for many years as surgeon to the 65th Mount Royal Rifles. More recently he filled the arduous post of president of many national and benevolent associations, and took a very active part in all measures designed to prevent the spread of tuberculosis, and to instruct and assist those who were already suffering from the white plague.

At the very earnest solicitation of many friends, in 1909, he undertook the duties of one of the Controllers of the City of Montreal, a position to which he was elected by a large majority of citizens of all classes, but he found the task of cleaning the Augean stables too great for his strength. All recognized, however, that during his tenure of office his influence was exerted in favour of the progress, well being and honest management of civic affairs. Sir William Osler, speaking of Professor Virchow, and commending his forceful public spirit, remarks: "It must be acknowledged that in this country physicians are, as a rule, poor citizens, taking little or no interest in civic, state, or national politics." Canada can show, however, not a few exceptions to this statement, and among these exceptions, Dr. E. P. Lachapelle will always hold a prominent place as the embodiment of duty and devotion to the public welfare.

Extensively travelled, well read, of great breadth of mind, and of very courteous manners, intercourse and companionship with him were always most agreeable. To him can be applied with perfect fitness this appreciation of Matthew Arnold, "Lucidity of thought, clearness and propriety of language, freedom from prejudice, freedom from stiffness, openness of mind, and amiability of manner." A French Canadian at heart, but with all and above all, a Canadian, who always unwaveringly worked for the intermingling and advancement of the whole profession; through his death our French confrères have lost a sympathetic leader, and the profession as a whole in Canada has lost a sincere friend.

MEDICAL ATTENDANCE ON DISCHARGED SOLDIERS

THE Medical profession is being asked by the Invalided Soldiers' Commission, through the Canadian Medical Association, to accept the schedule fees promulgated by the Workmen's Compensation Board of Ontario as suitable remuneration for medical attendance on discharged soldiers where their illness is a result of wounds or sickness contracted on active service. If this is a temporary arrangement to be superseded at the end of the war by other plans, the profession of Canada will probably do all in their power to assist the government in this particular work. On the other hand, however, if it is to be a final solution of the question, we fear that only dissatisfaction and failure will result.

For many many years after the war is ended, the soldier who has received a disability as a result of service will be with us, and no doubt will require from time to time medical attendance in his own home, or in hospital, and this service will largely fall upon the civil practitioners. This being the case, the question is not so much one of War-time necessity, but rather of demobilization and subsequent periods. We believe, therefore, that the acceptance of a schedule of fees

that was prepared by the Workmen's Compensation Board of Ontario for accidents only will fail when applied to a question of the magnitude of the present one.

In a country as large as Canada the conditions of practice vary very much, and what might be considered a reasonable arrangement in one part might be quite unacceptable in another part.

In view, therefore, of the largeness of the question, would it not be better for the Invalided Soldiers' Commission, through its proper officers, to meet the Canadian Medical Association, or representatives of the various Provincial Associations, at an early date and give careful consideration to the problems from both sides, and out of such a conference, evolve a plan that will be satisfactory both to the Commission and to the Profession, and one that will be workable in all parts of Canada?

St. Cloud is another of the most efficient Canadian hospitals in France; it was given by the Canadian Government for the treatment of French poilus, and is under dual control. The French Government supplied the huts and the Canadian Government furnished them. Each hut is named after some province or city in Canada. Each hut averages twenty-eight beds, and 60 per cent. of the staff is French Canadian, while the full staff numbers two hundred and twenty-three. The officer in command is Lieutenant-Colonel Casgrain, of Windsor, Ontario.

At the evening session of the Moose Jaw Baby Welfare campaign, Mr. Dobson took up the question of Mental Hygiene. He explained the difference between the physically defective and the mentally defective, and urged for the latter, not a hospital, but a school of special education where the rest of the faculties can be developed, and the work can be

done by them that others have planned. He took pains to point out that there was no stigma attached to mental disease any more than to physical diseases. He deplored the feeble-minded being allowed to marry, and gave cases from actual life to drive home the law of heredity. From 60 to 80 per cent. of mental defectives are due to this cause. In Canada the number of feeble-minded is from three to five per thousand, which at that rate would give the Western provinces five thousand feeble-minded. He stated that in the province of Alberta there were one hundred mental defectives in the schools; in Ontario, seven thousand, and in the Dominion, fifteen thousand.

Dr. H. L. Abramson, who is widely known in connexion with his previous work with infantile paralysis in New York, arrived recently in St. John, to assume the charge of the Provincial Laboratory. He gave a very interesting account of the relation of the laboratory to sanitation and public health generally and the practical importance of its work. It had a dual function, one of a creative, the other of a routine nature; the latter consisted in the carrying out in a routine line the facts which had been elicited by the creative work. He instanced the work of Pasteur as creative in its function, and from it had come that great development of sanitary science which had broadened out and multiplied so that instead of having one laboratory for research work, we have now a multiplicity, each dealing with some special subject. He cited as examples of the product of the creative function, diphtheria anti-toxin, tetanus anti-toxin, anti-typhus vaccination, and tests for the detection of syphilitic serum, all of which play an enormous part in the maintenance of general public health to-day. A special method of detecting meningitis carriers had been discovered, and a combination of bacteriological and serological tests, by which isolation can now be specialized instead of making a general quarantine

necessary. Dr. Abramson emphasized the routine work of the Provincial Laboratory—the examination of milk and water for evidences of pollution or bacterial contamination; the examination of blood for infectious diseases; the taking of throat cultures to detect the presence of diphtheria. It would also be called upon to co-operate with the health authorities to watch over typhoid cases and prevent epidemics occurring through lack of precautions, and would be prepared to give anti-typhoid inoculations. In short, as he tersely concluded, "The laboratory was the corner-stone of the whole structure."

COLONEL J. M. ELDER, of Westmount, who succeeded Colonel Birkett, C.B., when the latter was invalided home, has just been appointed a consultant surgeon for the area of Rouen. There has been some criticism on the fact that some of the ablest physicians and surgeons were being allocated to administrative work, their special professional knowledge being lost to the hospitals. The appointment of Colonel Elder means that his professional abilities are again in constant exercise instead of being crowded out by administrative duties. The appointment is under the R. A. M. C., and may be taken as a tribute to the good surgical work Dr. Elder has done at McGill Hospital.

The new commanding officer for McGill Hospital is understood to be Colonel Lorne Drum, who until recently was A.D.M.S. for the 5th Division.

Obituary

DR. HUGH LANG

THE death of Dr. Hugh Lang, of Granton, removes one of the typical country practitioners who was beloved by every one in the district. Dr. Lang was born near Birr, seventy-two years ago, and, after graduating from Toronto University, he settled in Granton for forty-seven years, where he practised his profession until the time of his death, which occurred suddenly, the cause assigned being apoplexy. The recent departure of one of his sons overseas, in the Royal Air Force, is thought to have weighed upon his mind, and possibly hastened his death. Two other sons, also physicians and residing in New York, survive him and one daughter. The funeral was held at Birr Cemetery.

Dr. Lang was a staunch Presbyterian. He was a Conservative in politics and was often approached with a view of his becoming a contestant for political honours, but he steadily refused to enter public life.

LIEUTENANT L. F. JAMIESON, R.A.M.C.

THE accidental death of Lieutenant L. F. Jamieson, came as a great shock to his relatives, friends and patients, who were eagerly looking forward to his return this fall to resume his practice at Grimsby. Dr. Jamieson felt so keenly the call to overseas service that, in order more speedily to get into active service at the front, he left Canada at his own expense and went directly to England. There he immediately signed up with the Imperial Medical Forces and was granted a commission. After serving in England and France for a brief period, he was attached to the Egyptian Expeditionary Force and went first to Alexandria, and then on to Palestine. Here he was attached to the London Field Ambulance and placed in charge of the hospital in Jerusalem. Later he assumed charge of the advanced dressing station, being with the attacking forces of the Artillery Brigade, and seeing both service east and west of the Jordan river, in the crossing of which he is supposed to have been drowned.

Dr. Jamieson was born in Ontario thirty-four years ago and

graduated from the Toronto Medical School with high standing in 1908. He went immediately to Parry Sound, where he built up an extensive practice, and was well known in the whole district, having been made District Coroner. Later he went to Grimsby, Ontario, after taking a post-graduate course in New York, and here he resided until the call to overseas service came. Kind, sympathetic and unselfish, he has left behind him a memory of "the beloved physician." He voluntarily chose a service of self-sacrifice to comfortable ease, and death has gathered him to the heroic fraternity.

DR. THOMAS SIMPSON, the last member but one of the graduating class in medicine of McGill University in 1854, passed away on July 11th, in his eighty-fifth year. He was born in Montreal in 1833. After graduating with honours he, later, took post-graduate courses at Edinburgh, London, and Paris. Returning to Canada, he settled in Algoma district, where, for fifteen years, he was coroner, Indian agent, and Government physician to the Indians. In 1872 he returned to Montreal to be attached to the General and Western Hospitals. From 1880, for six years, he was professor of Bishop's College, University Medical School. He also served on a Government Commission to study typhoid fever at the same time.

DR. TANCREDE FORTIER, of Beauce, died at the Hotel Dieu Hospital, Quebec, after a long illness.

DR. W. M. BRUCE, a well-known Toronto physician, died at his residence in that city at the age of sixty-six years.

RELATIVES have been advised of the death of Dr. H. Walker, at Kamloops, B.C., on July 12th. He was born at Ingersoll, and received his medical degree at Toronto University. Dr. Walker had been mayor of Wetaskiwin, where he resided for the last fifteen years, and medical superintendent and physician for the Indian Reserve.

DR. COLIN MCLARTY, a life-long resident of St. Thomas, died at his home there at the age of sixty-nine. He graduated from Toronto University, later qualifying as a member of the Royal College of Surgeons, London. He was also a Licentiate of the Royal College of Physicians, Edinburgh.

Miscellany

News

MARITIME PROVINCE

THE sixty-fifth annual meeting of the Medical Society of Nova Scotia was held at Liverpool, N.S., on July 3rd, under the presidency of Dr. J. W. Smith, of Liverpool. In respect of the number of members in attendance and of the character of the papers read, the meeting was highly successful.

Amongst the papers read were:

"Functional diagnosis and general therapeutics of diseases of the heart," by Dr. W. S. Morrow, Montreal; "Some aspects of the venereal disease problem," by Dr. Gordon Bates, Toronto; and "A casualty clearing station in France," by Colonel F. S. L. Ford, C.M.G., C.A.M.C.

Professor Nicholls, Halifax, gave a paper on "Soldiers' sore throat".

Dr. George M. Murphy, of Halifax, was chosen president for next year's meeting, the place of which was decided as Antigonish; first vice-president, A. E. J. Forbes, Lunenburg; second vice-president, B. Francis, Sydney Mines. Dr. J. R. Corston, of Halifax, was re-elected secretary-treasurer.

NOVA SCOTIA

THE annual meeting of the Association of Medical Health Officers of Nova Scotia was held at Liverpool, July 4th. There was a good attendance despite the fact that a large percentage of the physicians of Nova Scotia are on active service with the Army Medical Corps, so that those who remain at home are very busy. An interesting and practical programme awakened keen interest and led to very instructive discussions. Dr. W. B. Moore, M.H.O. of Kentville, was elected president for the ensuing year.

THE Public Health Act was amended during the last session of the provincial legislature by the addition of a number of sections

dealing with the venereal diseases. The new legislation provides for the reporting of venereal diseases, for the examination of suspects, for laboratory diagnosis and hospital treatment, prohibits treatment by any except qualified medical practitioners, prohibits advertising of quack remedies, etc., and makes it an offence for any venereally infected person to suffer any act which may lead to the infection of any other person.

A co-operative committee for veneral control in Military District No. 6 has been formed in Halifax, with the provincial health officer (Captain W. H. Hattie, A.M.C.) as chairman, and other medical officers representing the army and navy as well as prominent citizens occupying other offices. The military authorities of Military District No. 6 have been dealing with this matter for some time, and the venereal incidence in enlisted men is now very small, although numerous cases of infection are still being found in men called up under the Military Service Act. This is in keeping with the general experience that venereal disease is more common amongst civilians than amongst soldiers.

NEW BRUNSWICK

At the convention of the New Brunswick Medical Society most instructive papers were read by Dr. A. E. Macaulay and Dr. H. L. Abramson, of St. John, and one prepared by Dr. W. D. Rankin, of Woodstock, was read by the secretary, as Dr. Rankin was unable to be present. The session just closed was one of the most successful in the thirty-eighth year of the history of the society.

ONTARIO

Dr. H. B. Anderson has been appointed by the Minister of Education, the Hon. Mr. Cody, Chief Medical Referee for the Ontario Branch of the Inspectors' and Teachers' Superannuation Fund Commission.

The annual meeting of the Ontario Medical Council was held June 25th to June 27th, 1918. The officers elected were: president; Dr. R. Ferguson; vice-president, Dr. A. T. Emmerson; registrar, treasurer, Dr. H. Wilberforce Aikins; solicitor, H. S. Osler, Esq.,

K.C.; auditor, James F. Lawson; stenographer, George Angus; prosecutor, John Fyfe.

The following medical colleges in the United States were added to the list of accredited colleges in Ontario:

1. Hahnemann Medical College of Philadelphia.
2. University of Michigan Homœopathic Medical School.
3. Boston University School of Medicine.

The Council passed a resolution asking the Militia and Defence Department to "reconsider the regulations relating to medical students under the Military Service Act".

The depletion of the profession throughout the Dominion by the demands of the Military Services and the reduction of the number of students in attendance at medical schools by voluntary enlistment and conscription has created a situation which must result in a complete breakdown of medical services, both civil and military in the near future.

The Council desires to represent to the Department of Militia and Defence the necessity of immediately making provision to continue the education of a sufficient number of students.

The Council is of the opinion that young men who completed their preliminary education and entered upon the study of medicine before attaining military age should be permitted to continue professional studies, and that this policy should be applied to the matriculation classes of this and subsequent years.

In January last the British War Office intimated that Canadian medical students who had completed one year of study and who were in any branch of military service overseas would be permitted to return to Canada to resume their studies. In view of the gravity of the situation, this Council requests that this privilege be extended to men who are in service overseas, and who prior to enlistment, had completed matriculation in medicine or had entered upon arts or science courses, in preparation for the study of medicine. It is suggested that the staff of the Khaki University assist in the selection of these men.

The following resolution was passed: "That whereas the medical examinations of the manhood of Canada, for military service, reveals a serious percentage of physically unfit, varying from 40 per cent. to 70 per cent., this Ontario Medical Council is of the opinion that some form of supervision of the health of the country should be instituted by the state, and suggests that this matter be referred to the proper departments in the Dominion and Ontario Governments."

It was decided to ask the Federal and Provincial Governments to modify the Patent Medicine Act, so as to prevent the misbranding of proprietary medicines, and the publication of "fake" testimonials, etc.

The Council also dealt with the question of the relations between its members and the provision of the Ontario Temperance Act. A report of this was published in our August number.

QUEBEC

THE seventh annual convention of the Public Health Services was marked by an unusual number of interesting addresses. The programme lasted for two days. The features of leading importance were: industrial hygiene; public health in the province of Quebec; duties of municipalities in regard to public health; help given to municipalities by the district health officers; the health department in a small municipality; venereal diseases; deficiencies in public health administration; the public health nurse; statistics on cancer; infantile hygiene; the laboratory in epidemiology; the anti-tuberculosis organization of the municipal health department of Montreal; the inauguration of the anti-tuberculosis league of the county of Temiscouata; prevention of tuberculosis; hospitalization of the tuberculosis patient; anti-tuberculosis clinic; and "Microbes, how they grow, live and die," with lantern slides, by Dr. A. Valée, Quebec. Dr. J. A. Jarry, Montreal, closed the convention with an address, "What we have done, What we are doing, and What we could do at the Bruchesi Institute."

THE result of the quarterly examinations of the provincial Pharmaceutical Association, conducted by the preliminary board of examiners resulted as follows: admitted as students of pharmacy, eight; passed on letters, seven; passed on sciences, two; fourteen passed on all subjects but one, and will have to present themselves at the next examination. The examiners were professors J. O. Casgrain and I. Gammell, of the Montreal High School, with J. E. Barnabe as supervisor and Victor Giroux, supervisor for Quebec and district. The final examinations will be held at Laval University, Quebec.

A DIRECT result of the Baby Welfare Exhibit, held in Montreal two months ago has been an increased attendance at all the centres, which has rapidly risen to two-and-a-half per cent. In May, six

thousand, five hundred individual feedings were distributed, and four hundred and thirteen mothers attended baby clinics.

THE relief fund campaign for Notre Dame Hospital closed with a total of $267,153.50. The directors of the hospital subscribed among themselves $10,000. By obtaining more than the $150,000 mark, the fund secures an additional subscription from Sir Rodolphe Forget for $100,000.

THE Medical Council of Canada, at the concluding session of its annual meeting at Ottawa, elected the following officers for the current year: honorary president, Sir T. G. Roddick (re-elected); Montreal; president, Dr. R. Eden Walker, New Westminster; vice-president, Dr. J. C. Connell, Kingston; registrar, Dr. R. W. Powell, Ottawa (re-elected); general counsel, F. H. Chrysler, K.C., Ottawa; auditor, G. L. Blatch, K.C., Ottawa.

THE report of the education committee contained the formation of boards for the examinations in Halifax and Montreal in October, 1918, and in Toronto and Winnipeg, in June, 1919. The council is a legislative body created under the Canada Medical Act for the purpose of setting a standard whereby the doctor securing the L.M.C.C. qualification is enabled to practise in all provinces of the Dominion. The curriculum of the council is intended to be a test of a man's fitness for a high qualification after he has secured his M.D. degree from his university.

AT the last convocation of Laval University, eighteen students of the faculty of medicine were awarded doctor's diplomas. Six of these passed with distinction and six with great distinction. The Leblanc silver medal was awarded to Alexander Sirois, and the bronze medal to Antoine Paradis.

BRITISH COLUMBIA

THE first convention of British Columbia hospitals was held in Vancouver this summer. It was an event of marked importance. Seventy-two hospitals were invited to send representatives and practically all responded. The convention opened in the auditorium of the University of British Columbia, June 26th, and lasted three days. Dr. C. H. Gatewood gave the opening address and at its

conclusion he was unanimously elected chairman of the convention, and Miss McKenzie, of the Victoria Jubilee Hospital, was nominated honorary secretary. The address to the delegates was delivered by Dr. MacEachern, superintendent of the General Hospital. More than a score of interesting papers and addresses from prominent speakers were presented in the five business sessions. Among the subjects down for discussion were: "The Standardization of Nurses' Courses of Study in British Columbia and the Affiliation with larger Training Schools"; "Financing Hospitals"; "The Hospital Pharmacy and the Hospital Laboratory"; "Problems of the Hospitals in Outlying Districts"; "Infectious Diseases and the Control of the Same"; "Hospital Architecture," etc.

DR. S. S. GOLDWATER has been designated by Surgeon-General Rupert Blue as a "consulting expert in the public health service", to act in the selection of a site for the establishment of a home for the care and treatment of persons afflicted with leprosy. Associated with Dr. Goldwater in this task will be Surgeon G. W. McCoy, director of the Hygienic Laboratory, and W. C. Woodward, health officer, District of Columbia.

THE Vancouver General Hospital shows a remarkable development in the last five years. In August, 1913, the patients numbered two hundred and twelve and the staff one hundred and eighty. To-day, patients number about twelve hundred and the staff five hundred and forty. Expenses are $60,000 a month and six thousand meals are served daily.

THE annual report of the Royal Jubilee Hospital was given at the twenty-eighth annual meeting of the directors of the institution on June 28th. The num ber of patients treated in all departments was 2,010, showing an increase of ninety-one. The daily average number of patients was one hundred and fifteen, and the total number of days' treatment was 42,138, an increase of 3,935 days over last year. Receipts for the year ending May 31st, 1918, were shown to total $44,258.47. The treasurers' cash statement for the year amounted to $101,558.69. Hospital bequests during the year to the amount of $5,800, were gratefully acknowledged.

ARMY MEDICAL SERVICES

COLONEL A. E. Ross, M.P., for Kingston, has been appointed Director of Medical Services for the Canadian section, general headquarters, in France. He has also been promoted Brigadier.

THE assistant medical directors for the territorial units carrying out the work of the Invalided Soldiers' Commission have been appointed by the Director of Medical Services, Lieutenant-Colonel F. McKelvey Bell, as follows: Maritime Provinces, Major Dugald Stewart; Ontario, Captain Edward Ryan; Manitoba Major K. McIvor; Saskatchewan, Captain W. C. Arnold; Alberta, Major D. R. Johnson; British Columbia, Major A. P. Proctor.

A NEW medical board of review has been appointed for the Toronto military district, which will now have four such bodies. The president of the board, Lieutenant-Colonel Henry Bascom, will be assisted by Captain C. C. Fissett, of Brantford, and Captain R. J. Gibson, of Sault Ste. Marie. The work of the new board is to assist in re-examination of men who are being constantly called out by the registrar.

CAPTAIN C. MACKAY has been appointed Medical Director in New Brunswick of the Invalided Soldiers' Commission.

CAPTAIN B. L. GUYATT has been appointed temporary O. C. of the hospital at Camp Borden.

MISS P. COURTICE has been appointed Matron of the Military Hospital at Whitby, Ontario. She went overseas in 1915 and served for twenty-two months at Salonika.

DR. H. WILLIAMSON is gazetted as major in the C.A.M.C. after three years' service in the corps overseas.

CAPTAIN T. HAROLD CREWS has been transferred from the Imperial army to the C.A.M.C., owing to the great demand in Canada for returned medical men with overseas experience. He has just arrived from France.

LIEUTENANT-COLONEL LE BEL, recently in charge of one of the largest of the main hospitals at St. Cloud, has returned. He was awarded the Legion of Honour by the French Government, in recognition of his efficient organization work in the French army, although he was in the British and Canadian services. The British Government donated Colonel Le Bel's services to the French Government, together with the gift of the St. Cloud Hospital.

LIEUTENANT-COLONEL C. E. EDGETT has been promoted to the head of the Canadian Veterinary Department overseas, his jurisdiction extending to England as well as to France.

DR. R. J. MANION has recently issued a volume "A Surgeon

in Arms," (Appleton's, New York; McLelland, Goodchild & Stewart, Toronto). Dr. Manion, as a Captain in the C.A.M.C., won the M.C. for gallantry at Vimy Ridge. Since then he was elected M.P. for Fort William and Rainy River constituency as a Unionist. With Dr. McGibbon, of Muskoka, he is one of the two medical M.P.'s who have won the Military Cross.

THE following Nursing Sisters of the Canadian Army Medical Corps have been awarded the Royal Red Cross by the King:

Miss Mabel Lindsay, Miss Mary B. Hubbs, Miss Theodora McKiel, Miss Alice Grindley. Royal Red Cross of the Second Class: Miss Elizabeth Campbell, Miss Mae Pritchard, Miss Edith Lumsden, Miss Jean Sword.

Nursing Sister A. B. McDonald has received a decoration in bronze from the French Government for faithful and heroic services to wounded soldiers.

Nursing Sister A. M. Cameron has been awarded the military medal for bravery and devotion to duty under enemy hospital bombardment.

The Military Medal has been awarded to Miss Evelyn Gordon Brown for conspicuous bravery under fire. She was the first woman to join the Canadian Army Service Corps, and is a member of the First Aid Nursing Yeomanry Motor Ambulance Convoy.

The Military Medal has been awarded to A. Gillespie, C.A.M.C.

DR. LAWSON, a graduate of Toronto University, who has been serving overseas in the C.A.M.C., has been admitted to membership in the Royal College of Surgeons in England.

DR. W. W. WHITE has been granted the temporary rank of Lieutenant-Colonel with the Canadian Army Medical Corps and will act as consulting surgeon with the department of medical services in military district No. 7 under Lieutenant-Colonel Jost.

THE Canadian Commissioner waited on Sir Robert Borden when in London, England, and presented him with the official record from the city of Joinville-le-Pont in which is situated the hospital recently presented by the Canadian Red Cross to France. The record set forth the resolution of the mayor and councillors that in testimony of respect, affection and gratitude to Canada, a street at present known as the "Rue des Corbeaux" should thereafter be designated the "Avenue des Canadiens".

THE return of the Hon. Dr. Beland to Canada recently, after his long imprisonment in Germany, was heralded with scenes of great public rejoicing. In the early days of the war, Dr. Beland ministered untiringly to the needs of the wounded, and could have retreated with the Belgian forces, but he preferred to stay by his patients. As a result he spent three years in confinement, mostly in the city fortress in Berlin, where he assisted the regular physician in the treatment of other prisoners.

MEMORIALS

A beautiful tablet to the memory of Lieutenant-Colonel John McCrae is to be placed in the Royal Victoria Hospital, Montreal, and contains the following inscription:

"In memory of Lieutenant-Colonel John McCrae, assistant pathologist and assistant physician, 1904–1917, chief of the medical division, No. 3 McGill Canadian General Hospital, Boulogne, France, consultant of the First Army. Died on active service in France, January 28th, 1918. Then follow the stanzas of Colonel McCrae's now famous poem, 'In Flander's Fields'."

THE Regina Medical Association will erect a tablet in the local General Hospital to the memory of Dr. E. E. Meek, of Regina, who was killed in France while operating on a wounded soldier in a Red Cross hospital bombed by German airmen.

CASUALTIES

Killed in Action

J. S. MORRISON, C.A.M.C., St. John, New Brunswick

Died on Active Service

NURSING SISTER MARION OVEREND, Peterboro, Ontario
NURSING SISTER ADA JANET ROSS, Edmonton
J. H. WEBB, C.A.M.C., Toronto
W. M. ROBB, St. John, New Brunswick

Medical Societies

No. 1 CANADIAN GENERAL HOSPITAL CLINICAL SOCIETY

Meeting January 17th, 1918

PRESENT the following officers: Majors Gwyn, MacDermot, Ower, Ruttan; Captains Baragar, Bunn, Forsyth, Logie, MacKay, McAskill, McPherson, Howes, More, Smith, Thomas, Wade, and a number of visitors including Colonel Raw, Major French, Captain McDonagh.

Programme

Case No. 1. Specimens of lung and thrombus in femoral vein from a case dying of broncho-pneumonia and empyema, secondary to an infected thrombus of the femoral vein. Demonstrated by Major Ower.

A case of five weeks' duration, deep, but of late, clean wound of the mid-thigh, in which persistent fever was followed by signs of broncho-pneumonia of the left side, subsequent pleurisy and empyema of the right side, which was opened and drained; beginning empyema of the left side, which had not been opened since it had developed in the last two days of a moribund existence. Of most particular interest was the thrombus in the femoral vein, in which streptococci could be demonstrated, and an illustration of which will appear later.

In the lungs could be demonstrated areas suggesting softened infarcts, and a diffuse broncho-pneumonia. The heart was enlarged; the musculature pale; the chordæ tendineæ much flattened; kidneys were enlarged, pale, and presented the appearance of an organ in an advanced state of parenchymatous degeneration.

Case No. 2. Case of diffuse pigmentation of the skin and mucous membranes. Demonstrated by Captain Howes.

Captain Howes in describing the case, stated that the pigmentation now was regular and distinct on hands and face. It had begun and was noticed two years ago. Previous to joining

the army, he had been at work as a sailor on a tug-boat, and from his description seems to have suffered neither from asthenia nor gastro-intestinal symptoms, two very important features in diagnosis of Addison's disease. There is at present some asthenia, following a short febrile attack, but the patient is bright, and eats heartily. The skin of the body is universally browned, and splotched with patches of deeper brown, and scars of scratch marks, due to lice; and body pigmentation must be considered as coming from this source.

There is no intensification of the pigment round the nipples or under the armpits. It has increased around the waist. The skin of the hands and face is the brownish hue described in Addison's disease, and in addition, there is a suggestion of cyanosis of the lips, nose and eyes. It is to be especially noted that the body pigmentation is clearing up with local cleansing, while the pigmentation of face and hands is evidently deepening.

On the gums, hard palate and inside of cheeks are many flecks of brown pigment. There is no anæmia nor deviation of the blood count from normal; urine shows no sugar or albumen. The case is of interest more as being one that is probably not Addison's disease.

Colonel Raw, of Liverpool Merchants Hospital, discussed the case, and congratulated Captain Howe on the way in which it had been presented. He was inclined to believe that the case was not one of Addison's disease, but was either due to a tuberculosis of the peritoneum, involving the sympathetic system, or to local infection of the skin from lice.

Major Gwyn detailed the many conditions which might give rise to pigmentation of the skin, and commented on the absence of of general symptoms, such as asthenia and gastro-intestinal symptoms, without which a diagnosis of Addison's disease was hardly possible.

Case No. 3 (a). *Report on the progress of the case of cholecystitis due to Para-Typhoid B. infection.* By Major MacDermot.

(b) *Case of acute appendicitis.* Reported by Captain Logie.

Captain Logie in speaking, said he was merely giving the details of a case of acute appendicitis which had come to operation, and had done well. Clinically the main feature had been intense cutaneous hyperæsthesia about and below McBurney's point, with a minimum amount of rigidity. The patient had entered the ward four hours before.

The white blood count was high, 15,000; temperature and pulse rate steadily increased while, the local signs persisted, and vomiting took place. Operation showed a perforated appendix, and considerable free fluid in the abdomen. Patient has done consistently well since operation.

Case No. 4. *Discussion on the case of enlarged spleen, presented at the previous meeting.*

Captain Logie in presenting the case for the second time, remarked that the only change to be noticed was a diminution in the amount of albumen in the patient's urine, and a disappearance of the physical signs of ascites. The patient is feeling more comfortable; little or no change to be noticed in the size of the spleen. He was now under regular anti-syphilitic treatment, in the shape of mercury inunctions and potassium iodide.

Captain McDonagh in discussing the case, remarked upon the fact that too many cases of Banti's disease did not appear as a clinical entity. A large number of these cases eventually proved to be due to tuberculosis and syphilis. He himself had seen cases in which both hereditary and acquired syphilis were demonstrated to be the cause of the enlarged spleen and the peculiar type of anæmia.

Captain Alexander MacKay cited a similar case occurring in his private practice. The Wassermann reaction had been positive. There had been severe hæmorrhage from the stomach, and the case had afterwards gone to the Mayo Clinic in Rochester, Minn., where the enlarged spleen was removed. The patient had made a good reovery.

Major Ower described enlarged spleens from the pathologist's standpoint, and enumerated the various histological alterations seen in the many disorders associated with spleno-megaly.

Major Gywn discussed the case at length, and dwelt upon the development of the idea that there was a type of disease beginning as the so-called splenic-anæmia, and ending as the condition now spoken of as Banti's disease. He described the various clinical states associated with enlarged spleens, and the differential diagnoses, as far as could be established, between the various conditions. He stated that, excluding the large spleens due to cysts or infarcts or tropical diseases such as malaria and kala-azar; excluding the enlarged spleens of pernicious anæmia, of leukæmias, which are usually to be recognized by their associated blood condition; excluding the spleens of Hodgkin's disease, known or

recognized by its associated condition in the glands, and its histological picture; excluding the enlarged spleens secondary to cirrhosis of the liver, to tuberculosis and late syphilitic infection, there seeemd to remain still the conditions spoken of as splenic-anæmia, the anæmia infantum pseudoleukemica, and the syndrome spoken of as Banti's disease. Whether these were all one and the same condition, the one being the disease as seen in infants and children; the other being the disease as seen in adults, is open to question, but such is the belief held by many clinicians to-day.

It was, he stated, no easy matter to make the diagnosis at any time, and case after case of anæmia with enlarged spleen had been thrown out of the category, owing to some existing cause, such as syphilis or thrombosus of the splenic veins being found. Of recent date has been the discovery in several instances of a persistent umbilical vein, which, by throwing extra work upon the portal system, had sooner or later caused endophlebitis of the splenic vein, an subsequent changes leading to enlargement of the spleen and anæmia. However, it had seemed to be well established, that the disease spoken of as splenic anæmia did in many cases run a chronic course, which terminated in a condition giving the picture of cirrhosis of the liver, and showing pathologically a well marked and apparently true cirrhosis. Syphilis probably did not account for all these cases. Clinically there were four well marked features of the disorder. (1) Its beginning as a splenic anæmia. (2) Its chronicity and division into stages. (3) The final development of the symptoms and pathological evidences of cirrhosis. (4) The fact, that, performed before the final stages of the disease, splenectomy has effected a cure.

The meeting then adjourned.

THE work on a thousand-bed hospital, to be erected at Ongwanda, is to commence at once, and it is proposed to erect at Barriefield camp two casualty huts, each capable of accommodating five hundred men. The hospital, which will eventually be converted into a soldiers' home, will have accommodation for seven hundred beds. There will also be a nurses' home, an isolation hospital, and a building for the treatment of certain diseases.